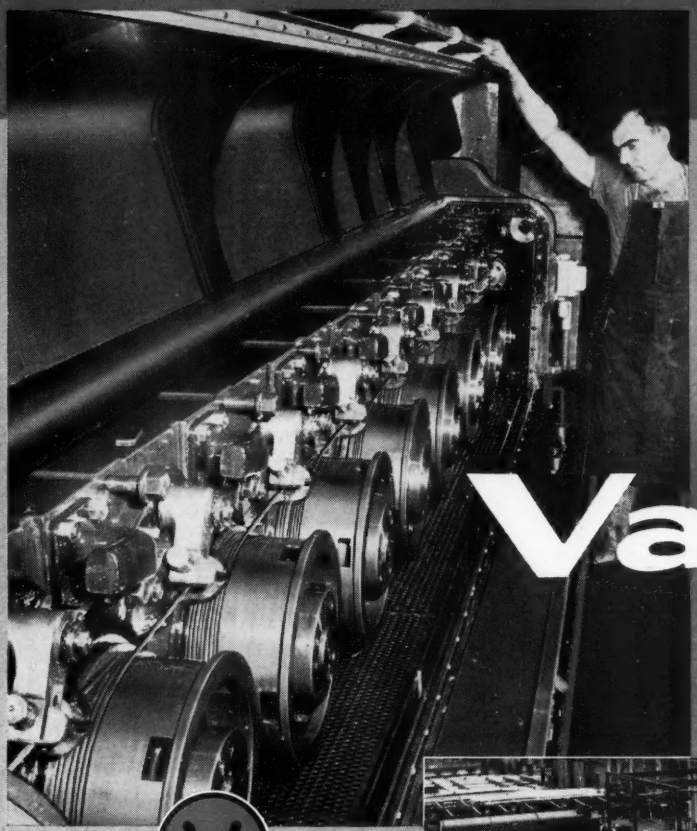
NOVEMBER 1955

# WIRE AND WIRE PRODUCTS

**HEAVY-DUTY AND *HIGH SPEED***
**in producing**
**NON-FERROUS ROD**

**Vaughn®**
**TANDEM MACHINES**

Vaughn Tandem Machines have power, speed and stamina to handle with ease your heaviest products in non-ferrous metals. Vaughn experience in design and manufacture is your guarantee of continuous operating satisfaction and long service life. Let us discuss your requirements!

*"Quick on the Draw!"*

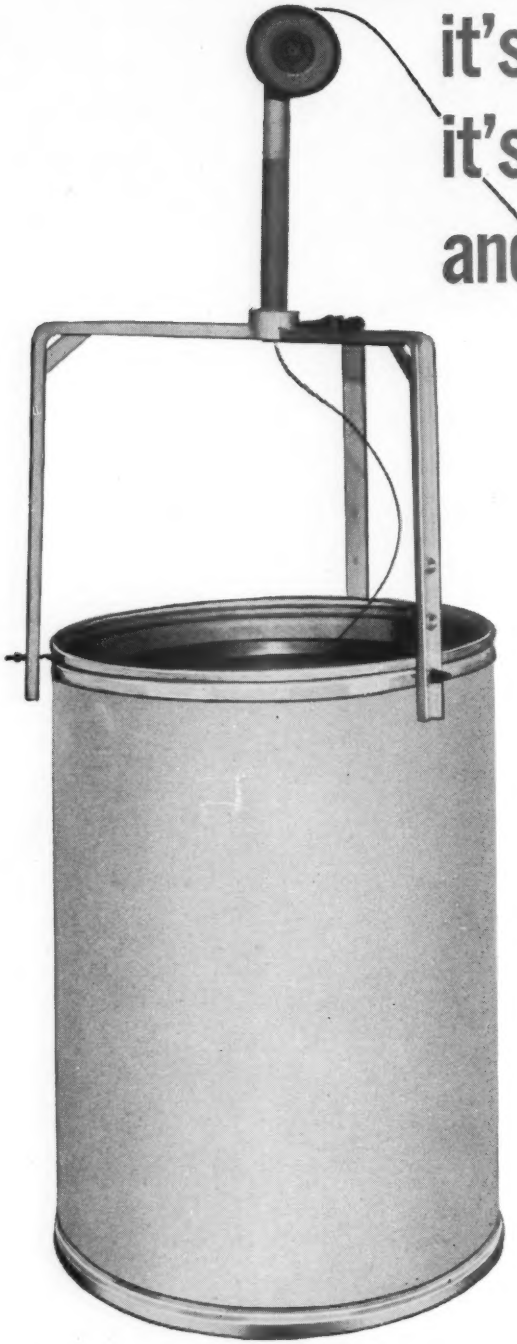
**The VAUGHN MACHINERY COMPANY**
**CUYAHOGA FALLS, OHIO, U. S. A.**

**COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole... for the Largest Bars and Tubes... for the Smallest Wire... Ferrous, Non-Ferrous Materials or their Alloys.**


OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

# Payoffpak...®

## it's new...it's different... it's ideal for handling and processing WIRE!



PAYOFFPAK—Continental's newest fibre container—offers wire manufacturers and fabricators a revolutionary new development in wire packaging, handling and dispensing.

*SAVES WORK*—Wire is automatically packaged in the Payoffpak as it is drawn, eliminating such operations as stripping, tying, handling, splitting and wrapping.

*SAVES TIME*—Payoffpak can hold 600 lbs. Downtime on the wire drawing machine, due to stripping operations, is greatly reduced.

*ELIMINATES REELS*—Single standard-size Payoffpak eliminates reels and need for wide range of block sizes.

*CUTS SHIPPING COSTS*—Inexpensive, light-weight Payoffpaks travel for less because of extremely light tare weight.

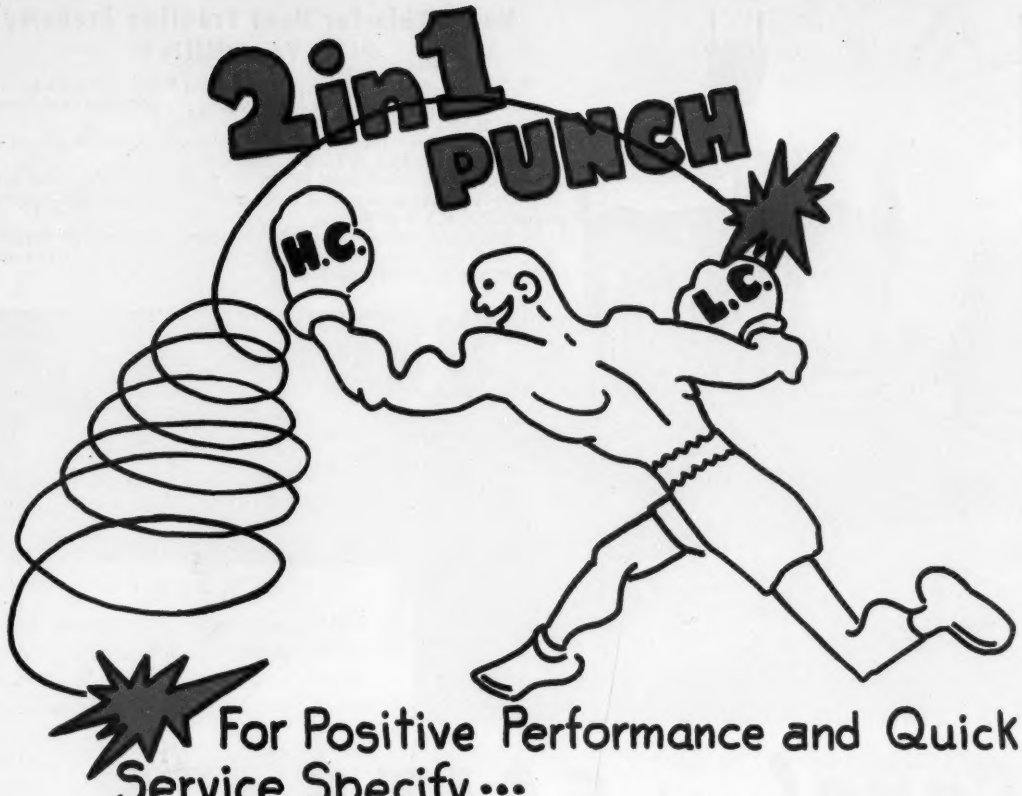
*HANDLES AND STACKS EASILY*—In-plant handling of Payoffpaks is easy with conventional hand trucks. High stacking strength means you can use maximum storage space, too.

A survey indicates that often more than 50 labor steps are needed to convert 500 pounds of steel wire in standard eight inch coils—but you can do the same job with Payoffpaks in an average of five operations. No wonder they are calling this new container "the long-playing record of the wire industry" See how Payoffpaks can pay off for you. Call Continental for complete information on this exciting new way to package, handle and dispense wire.

**CONTINENTAL CAN COMPANY**

**FIBRE DRUM DIVISION • VAN WERT, OHIO**

New York • Philadelphia • Pittsburgh • Tonawanda • Cleveland • Chicago
Atlanta • St. Louis • San Francisco • Los Angeles • Eau Claire




For Positive Performance and Quick Service Specify ...

## "America's Finest Wire Drawing Lubricants"

**HAVE YOU INVESTIGATED**

## Standard 55?

More Rope Wire Is Drawn Thru Standard No. 55 Than All The Rest of the Wire Drawing Lubricants Combined.

Standard No. 55 Has Numerous Other Splendid Applications—May We Show You Why?

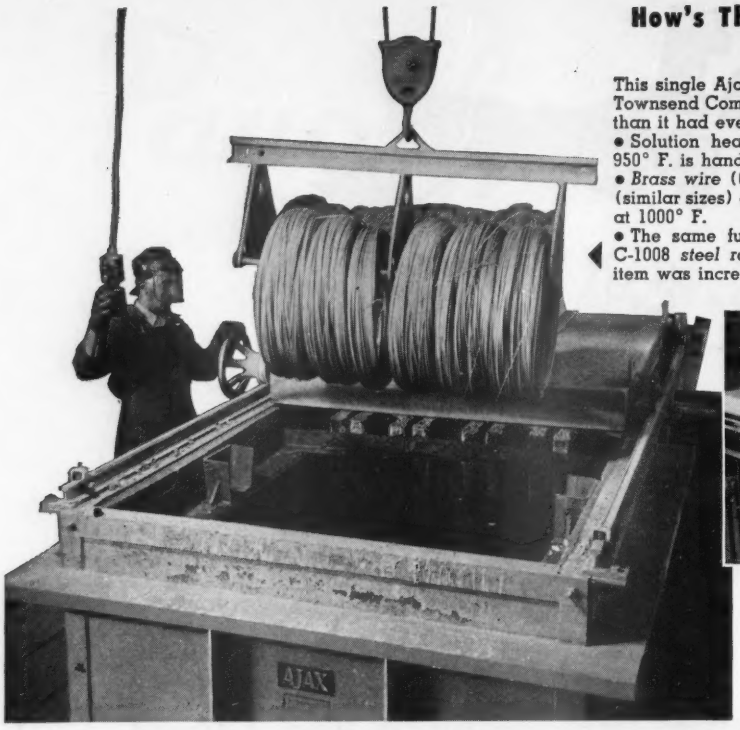
Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

**Standard Industrial COMPOUNDS CO., INC.**

**4600 WEST FERDINAND STREET**

**CHICAGO 44, ILLINOIS**

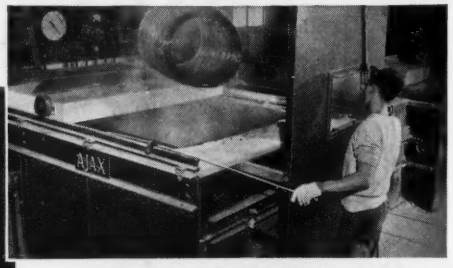
**TELEPHONES: Mansfield 6-9324-5-6**




## How's This for Heat Treating Economy PLUS Versatility?

This single Ajax Salt Bath Furnace does 3 different jobs for the Townsend Company, New Brighton, Pa. . . . and does each better than it had ever been done before.

- Solution heat treating of four different *aluminum alloys* at 950° F. is handled at 1,000 pounds per hour.
- *Brass wire* (65-35 from 1/16" to 3/8" diameter) and *copper wire* (similar sizes) annealed in batches of 1,000 pounds in 30 minutes at 1000° F.
- The same furnace is used for stress relieving cold headed C-1008 *steel rods* ½-inch in diameter. Production of this one item was increased 400%!




**DONE IN MINUTES!**

A 250-pound charge of stainless steel wire is quickly brought to annealing temperature of 1850° F. in this Ajax electric salt bath furnace. Wire is essentially used for welding rods.

# *Save!* with SALT BATH HEAT TREATING...the AJAX way!

No other process can match the Ajax Electric Salt Bath Furnace, for speed or low cost of equipment in the heat treating of steel, and non-ferrous wire.

You get greater and faster production in less floor space. Quality is improved—wire is heated more uniformly. Atmospheric effects (scaling and decarburization) are eliminated.

Summing up—the advantages of the Ajax Electric Salt Bath Furnace in specific applications are:

**PROCESS ANNEALING** . . . Bigger furnace charges heat treated in minutes instead of hours . . . scale eliminated . . . lowest over-all equipment investment . . . smallest floor-space requirement.

**DESCALING** . . . More work handled in less time . . . greatly reduced metal loss . . . minimized acid consumption by the Du Pont, the Virgo or the "Kolene" process.

**PATENTING** . . . Faster production with greater product uniformity . . . lower operating costs and, in many cases, the elimination of a separate cleaning operation.

**CLEANING, PREHEATING and FLUXING** (preparatory to aluminizing or other special processing) . . . Clean, scale-free surfaces obtained more quickly and at appreciably less cost.

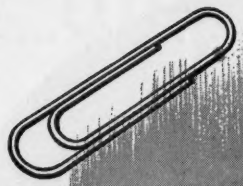
Write for case histories—or, better yet, send a representative batch of work to our laboratory for treatment to prove our claims—no obligation.

AJAX ® HULTGREN

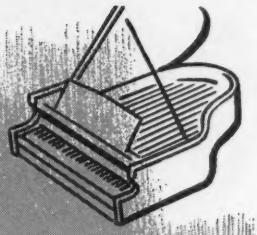
*Associate Companies:* Ajax Electric Furnace Corporation, Ajax Engineering Corporation, Ajax Electrothermic Corporation

**electric SALT BATH furnaces**

**AJAX ELECTRIC COMPANY • 928 Frankford Avenue, Philadelphia 23, Pa.**



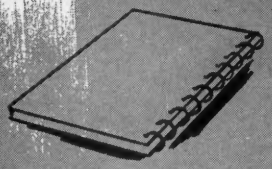
WIRE FOR PAPER CLIPS



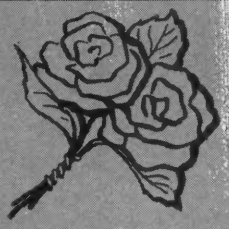
PIANO COVERING WIRE

# *Whatever your problem is in*

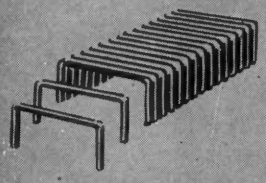
# *Wire...*



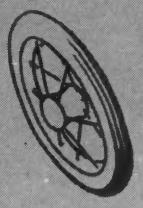
COIL BINDING WIRE



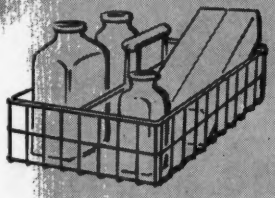
FLORIST WIRE



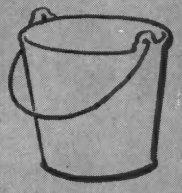
PREFORMED STAPLE WIRE



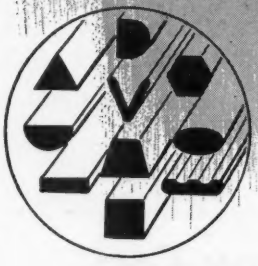
WIRE FOR TOY WHEELS



WIRE FOR MILK BOTTLE CARRIERS



WIRE BALES FOR BUCKETS, PAILS, ETC.



STANDARD AND SPECIAL WIRE SHAPES

Thousands of wire applications in over a half century—involving virtually every kind of a wire problem—that's the experience and background we offer you in solving *your* special wire problems. We can supply wire from almost the size of a human hair, through 9/16″ diameter for metal fasteners . . . round wire or wire in special shapes, practically any size, temper, finish and analysis in low carbon and medium low carbon steels. We may have a valuable case history that parallels your own special problem. Fill out and return the coupon for full details of Continental's Wire Service. We are eager to work with you.

**FILL OUT AND MAIL TODAY**

**CONTINENTAL STEEL CORP., KOKOMO, IND.**

Gentlemen: Please give us without obligation complete details of your special wire service.

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**STEEL CORPORATION • KOKOMO, INDIANA**

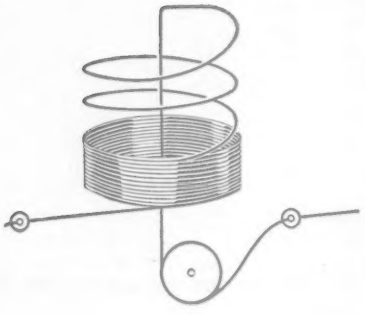
**PRODUCERS OF:** Manufacturer's Wire in many sizes, shapes, tempers, and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, and special wire. ALSO Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

# 25 years

• have proven
Quality and Low Cost
at this mill

# MORGAN-CONNOR

## Machines can bring You these benefits



Economy of Floor Space

High Production

Long Die Life

All this totals—Low Cost

•

*why not put them to work for you?*

WM-91

**Morgan Construction Company** WORCESTER, MASS.

ROLLING MILLS • MORGOIL BEARINGS • REGENERATIVE FURNACE CONTROL • EJECTORS • GAS PRODUCERS

# WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 30 November, 1955 No. 11

Designated as Official Publication By The Wire Association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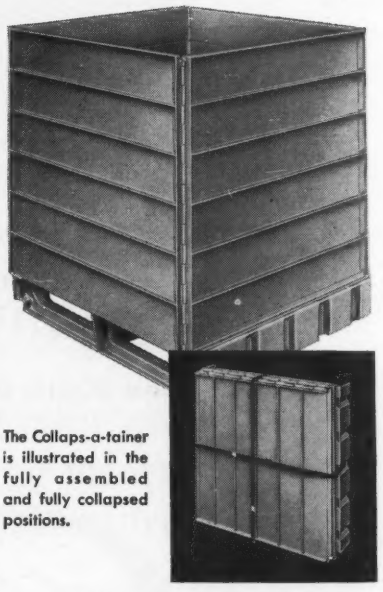

The Collaps-a-tainer is illustrated in the fully assembled and fully collapsed positions.

**YOU CAN REDUCE COSTS ON INTERPLANT SHIPPING**

***with***

# Collaps-a-tainer

This steel box that folds flat is designed to make more trips than any other lightweight box. It is built to give maximum strength with minimum weight.

Have your traffic manager figure your cost of returning empty containers. Then compare with savings possible from using the Collaps-a-tainer. Four collapsed units ship in the space of one open unit. Collaps-a-tainer can be used on the production line or as a storage bin.

**CHECK THESE FEATURES**

- ✓ Lightweight
- ✓ Rigid and Strong
- ✓ Easy to Assemble
- ✓ Stacks Safely
- ✓ Compact to Return
- ✓ Durable
- ✓ Easy to Knock Down
- ✓ Cuts Handling Costs

For more information on the Collaps-a-tainer write for Booklet 615-R.

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*Pressed Steel Division*

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Export Dept.: Chrysler Building, New York 17, New York

# Story of a gal who couldn't cook

**(or why use ELGIN Diamond)**

When Susie walked down the street strange things happened. Men winked, wives frowned, cops whistled and cabbies tooted. Susie was a dish—charm in carload lots—sweet but shrewd, lovable but aloof.

As nature would have it, all the boys loved Susie and Susie loved the boys . . . especially when boys meant diamonds. This went on at a mad, happy pace until one sunny day Susie met Herbert. Right then and there, Susie knew that Herbert was for her. But, alas and alack, Herbert just couldn't see Susie. He couldn't—that is—until Susie had him over for dinner one night. Now, kitchen duty just wasn't Susie's strong suit. But, wily as she was, Susie changed her ways . . . made the cutest little ready-mix, no-mistake cake you ever did see. That did it . . . the crack in Herbert's armor was food. Herbert loved food. Herbert went simply c-r-a-z-y over food. Ah, glorious Waterloo . . . Herbert was hooked.

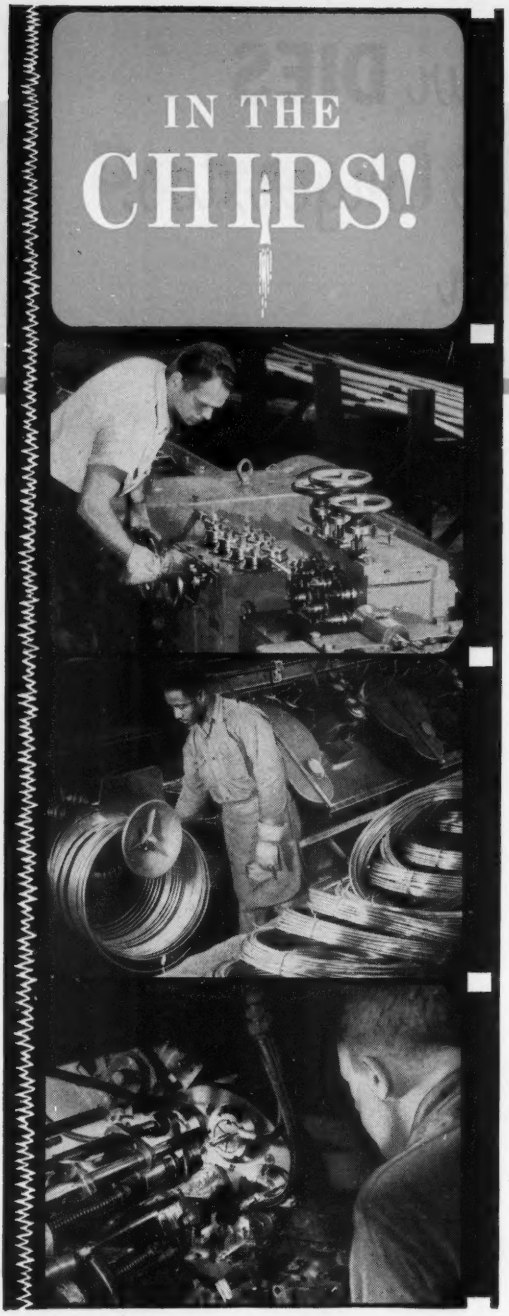
A foul deed you say? No! In this day and age, lots of things are ready-mixed and if a girl—*or anyone*—can use them to advantage . . . why not? Fact of the matter is, you're just as likely to find a ready-mixed product on the workbenches of industry as you are on the pantry shelf at home.

And that about tells the story of Elgin Diamond. For you see—Elgin Diamond is a ready-mixed abrasive which means there's no mixing or grading, no waste or error. And with Elgin's exclusive way of permanently suspending diamond particles in a specially formulated, color-identified vehicle—you get consistent polishing quality, too.

If you haven't already discovered what a wonderful product Elgin Diamond is, you certainly owe it to yourself to try it.

**ELGIN NATIONAL WATCH COMPANY**

**ABRASIVES DIVISION ELGIN, ILLINOIS, Dept. G**




# ...see CHASE'S newest movie!

16mm Sound and Full Color!

## 24 minutes of exciting information for manufacturers of

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- WIRE PRODUCTS
- NON-FERROUS FORGINGS

"IN THE CHIPS" reveals how men and machines work together to give you easier-working, cost-reducing brass and other copper alloy rod and wire.

You see remarkable close-ups of modern screw machine operations—including incredibly fast and accurate turning, deep drilling, reaming and tapping. There are fantastic slow-motion sequences of almost-human machines that transform wire into finished products at lightning speed!

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# Your **DIES** last longer, too, with **DURPONS®**

We've stressed so often the fact that in wet drawing non-ferrous metals, Nopco Durpon Drawing Compounds last *twice as long*, and cost no more...you may have overlooked the fact that Durpons also mean *much longer life for your dies*. Which factor makes for the *biggest* saving, we hardly know. Both are well worth having.

The reasons for this long life are two: a buffer which prevents the breakdown of the emulsion, and a sequestering agent which keeps the bath *clean*. Try these money-saving compounds and see for yourself. Mail the coupon today.

### *"Stay Stable Longer"*

**DURPON**—*for intermediate gauge wire*
**DURPON L**—*for heavy wire, rods, and tubes*
**DURPON FW**—*for fine wire*

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372 Industrial Street, Harrison, N. J.
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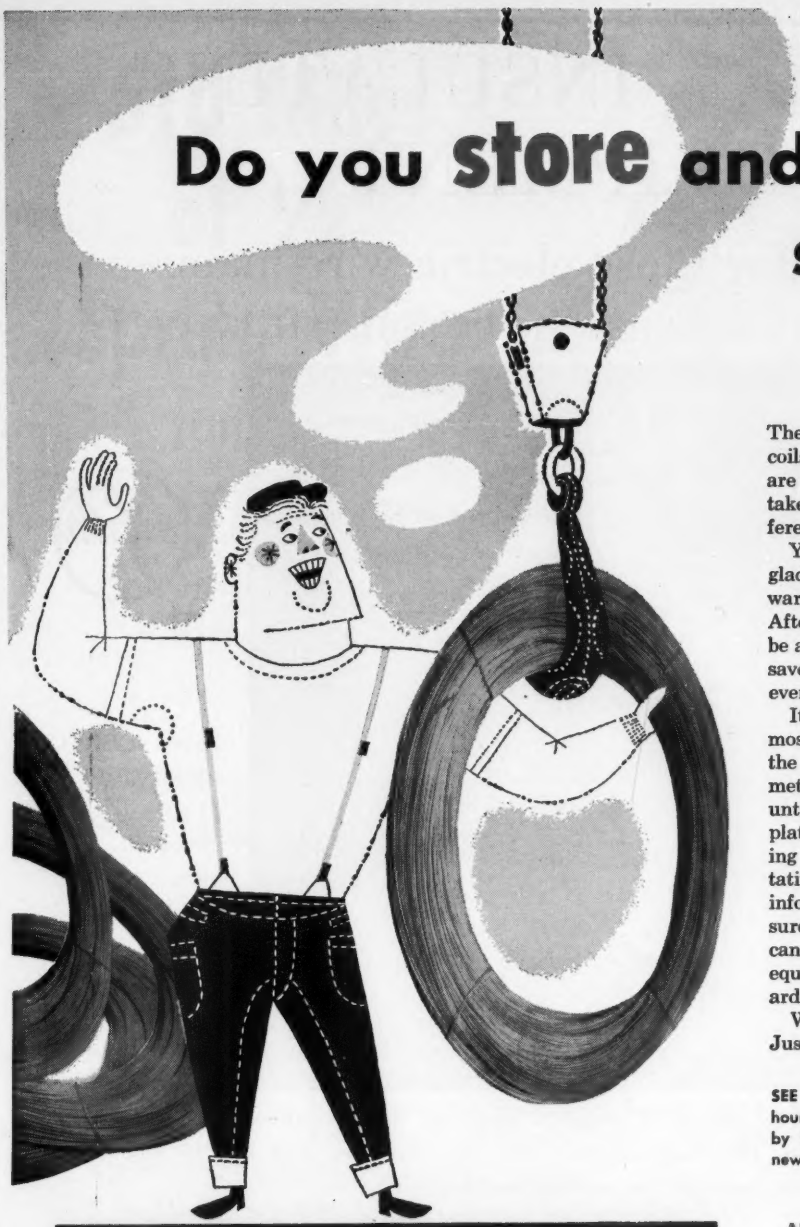


# Do you store and handle steel wire?

The storage and handling of steel wire coils is an art all its own. So if you are faced with the problem, why not take advantage of the free advice offered by American Steel & Wire?

Your AS&W representative will be glad to go over your present or future warehouse and handling facilities. After sizing up the situation, he may be able to offer sound advice that will save you many thousands of dollars every year.

It's a big problem, involving the most economical size coils to order, the most efficient in-plant handling methods, and how to store the coils until they are used. If you contemplate the design of new wire fabricating equipment, your AS&W representative can give you valuable design information. That way, you can be sure that the machinery you design can be served with approved handling equipment, and use lower cost, standard steel wire coils.

Want to take us up on the offer? Just call your local AS&W salesman.

**SEE** The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

## USS AMERICAN MANUFACTURERS WIRE

**AMERICAN MANUFACTURERS WIRE**

**AMERFINE**—*High quality fine wire.*

**AMERSPRING**—*music steel spring wire.*

**AMERLOY**—*alloy heading wire.*

**AMERTEMP**—*heavy-duty oil-tempered wire.*

**AMERHEAD**—*uniform heading wire.*

**AMERSTITCH**—*extra-tough metal stitching wire.*

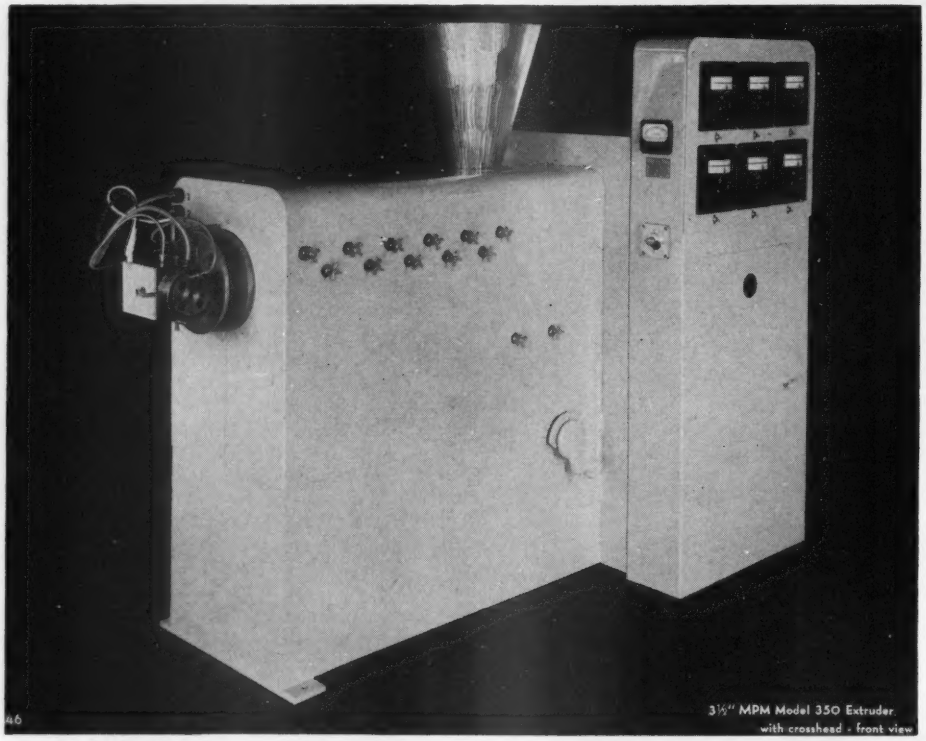
USS

**AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO**
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

**UNITED STATES STEEL**

# *"Modern"* INSULATING EQUIPMENT

## is designed for those electric wire manufacturers who demand the best in extruders.




Shown at left: 3½" MPM Model No. 350 Extruder with crosshead, front view.

MPM Extruders are used by nearly all material suppliers, by laboratories for quality testing, and for production. One large electric wire manufacturer now has 17 MPM Extruders-reorders for them indicate the satisfaction they give.

*MPM Extruders have the utmost flexibility and will handle a wide range of compounds and cross sections, as they are equipped with the best in temperature controls.*

Literature upon request with questionnaire to determine the sizes, types and production requirements. MPM equipment is used in all principal foreign countries, indicating flexibility with many compounds.

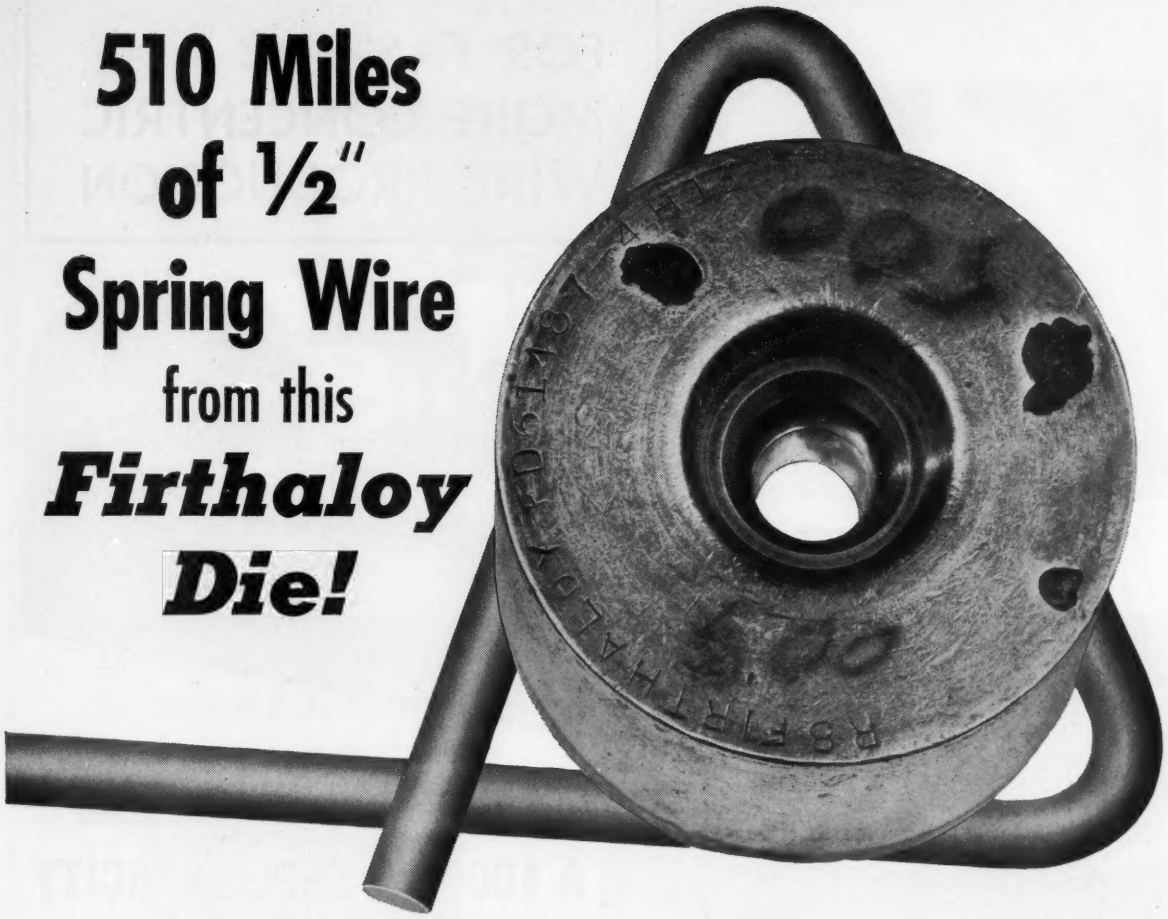
Complete line of accessory equipment, such as dual take-ups, capstans, spark testers, measuring units etc.

**MODERN PLASTIC MACHINERY CORP.**

**15 UNION STREET • LODI, NEW JERSEY, U.S.A.**

**Telephone GRegory 3-6218**

# 510 Miles of ½" Spring Wire from this *Firthaloy Die!*




The unretouched photo of the Firthaloy draw die above may not be very pretty—but what die would be after drawing 1,800,000 lbs. of ½" high carbon spring wire! The important fact is, that despite the appearance of the steel casing, the Firthaloy carbide nib (standard grade H-13) had worn *only 1/1000 of an inch when it was retired after 6 years of continuous service!*

The leading New England manufacturer who returned the die to us for our "museum" thinks his 1948 purchase was a good one.

You, too, can get comparable results when you specify *Firthaloy* for your own die shop or from your tool and die maker . . . in round, square, hex and all special shapes.

*Write for information or literature today*

*Mr. Tooley says—*

"Firth Sterling offers wire manufacturers and fabricators the advantages of a *single* source of supply for both tungsten carbide dies and high grade die steels. This *complete* line, from famous Firthaloy carbide through almost one hundred grades of high speed and tool steels saves you time and money."

R-312

**Firth Sterling**

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

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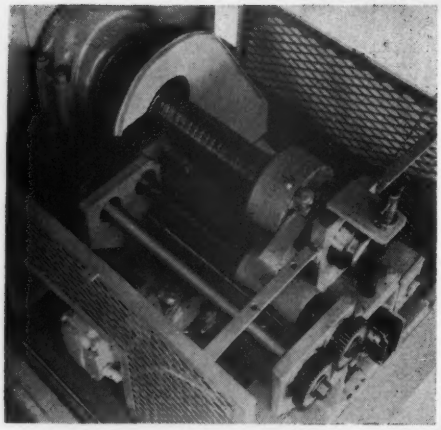
OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

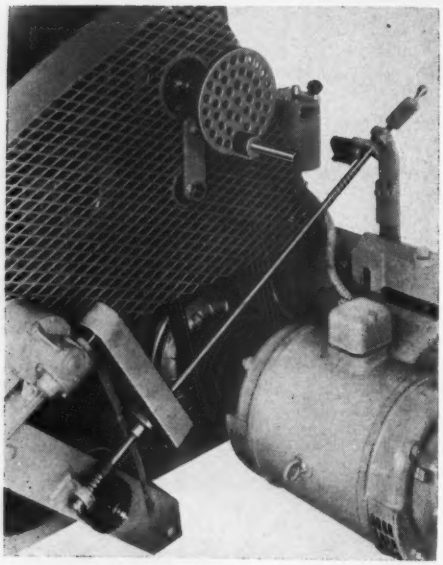
PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

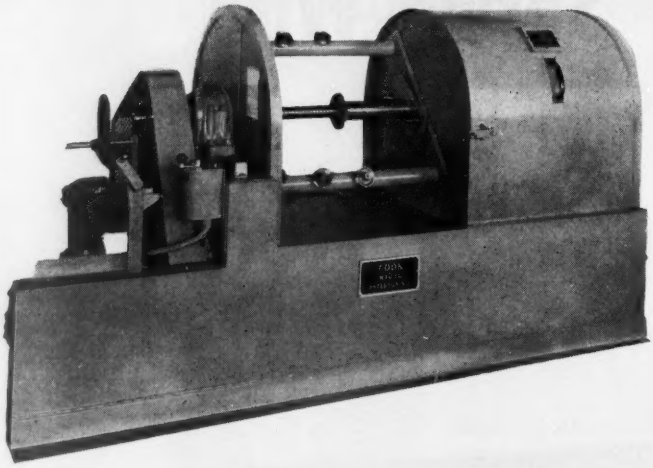
# FOR FASTER, MORE CONCENTRIC WIRE PRODUCTION



Adjustable Screw-type Traverse



Fluid Coupling and Lay-changing Control Mechanism



## NEW COOK BH-24 HAS A 1000 lb. REEL CAPACITY

## Saves money in a longer run!

Reel Size 24" x 14" x 12" x 5"

Increased capacity—no sacrifice in concentricity.

Operating controls are fully accessible at all times.

Fluid coupling permits smooth, top speed acceleration.

Adjustable traverse motion and speed changes to accommodate varying reel widths and wire sizes.

*compare*

# COOK MANUFACTURING CO.

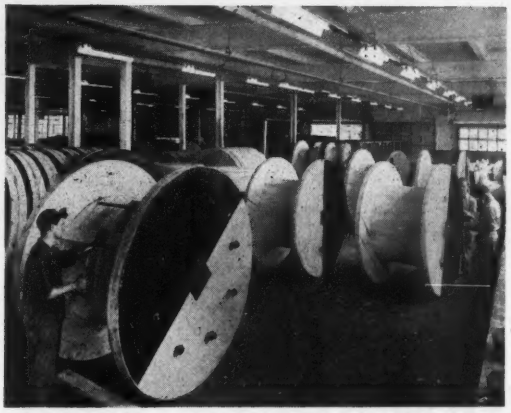
*For Quality, Performance and Cost... For Longer Life!*

50 EAST 25TH STREET • PATERSON, N. J. • ARmory 4-6380 . . . *inquiries invited*

# ever STOP and think....

**of what it costs $ annually to ship your Electrical Wire and Cable the old fashioned way?**

**NOW is the time to check and compare with the savings that can be realized by the use of NON-RETURNABLE wood shipping reels.**



**Look at these advantages:**

- *Reduced Reel Investment*
- *Less Storage Space*
- *Lower Freight Costs*
- *No Repair Costs*
- *No Return Freight Costs*
- *No Bookkeeping*
- *No Cash Deposits Req'd.*
- *No More Headaches ! !*

**MANY of your current problems can either be greatly reduced or completely eliminated through the use and advantages of NON-RETURNABLES.**

NON-RETURNABLE REELS ALLOW DEFINITE PACKAGING COSTS.

HIGH SPEED
**SHIPPING SERVICE in our... OWN TRUCKS**
within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

**BRIDGE**
MANUFACTURING COMPANY
HAZARDVILLE, CONNECTICUT
Telephone . . .
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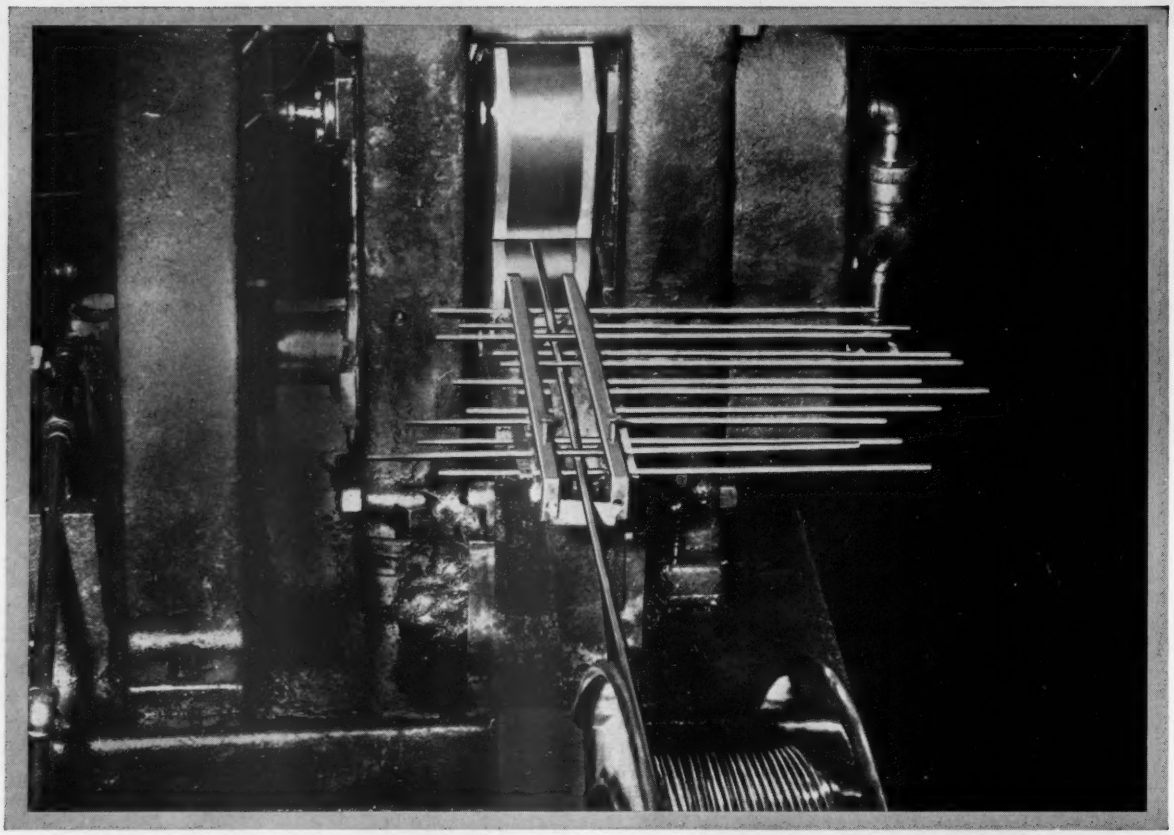
Riverview 9-8308

*"REEL GOOD . . .*
Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.
*WOOD REELS"*



Carbide rolls flatten tough stainless steel...

# More than a year on the same spot —and still producing perfect wire

After ten million revolutions – more than a year of continuous running on the same spot – these Carboloy® cemented carbide rolls at the Knowles Loom Reed Works, Inc., showed no signs of wear.

In contrast, the steel rolls formerly used for flattening stainless-steel wire into precision textile loom reeds required spot changes every two weeks.

The benefits this New Bedford, Mass., firm received from Carboloy cemented carbides did not end with improved roll life.

**Manpower savings:** Steel rolls expanded and contracted under the heat of the run, requiring a man on every machine to inspect reed tolerances. Because carbides were not affected by heat, one man now handles several machines, freeing manpower for other jobs. And, all machine downtime due to roll changes as well as roll refinishing was eliminated.

**Quality improvements:** Steel rolls mushed as they wore, crowning the wire and causing rejects. Carbides held uniform tolerances, and the rolls' lasting high-luster finish was imparted to the reeds, making them more marketable.

This Knowles case history of improved product quality, longer roll life, reduced manpower and maintenance costs, is typical of the benefits Carboloy cemented carbides are bringing to the wire industry.

Whether your business is flattening, drawing, extruding, or heading, there's a Carboloy product to fit your needs. For more information, or in-plant assistance from a Carboloy Wire Die Engineer, write today.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

**CARBOLOY**
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11171 E. 8 Mile Road, Detroit 32, Michigan

**Carboloy Created-Metals for Industrial Progress**

a complete line of...

# TANDEMS

for HEAVY WIRE DRAWING in COPPER • ALUMINUM • and their alloys

- HIGH Speed!
- MINIMUM Slip!
- SPOOLS and COILS!
- HARD faced BLOCKS!
- AUTOMATIC Lubrication!
- LOW Maintenance!
- ADJUSTABLE dieholders!
- HEAVY construction!

SYNCRO Tandem design provides a basic machine employing highly efficient component BLOCK drive assemblies. Inbuilt characteristics of this line allow the utmost in drawing versatility.

WRITE for complete information

SYNCRO MACHINE COMPANY

PERTH AMBOY • NEW JERSEY • USA

SYNCRO®

*Better Machinery for the Wire Industry*

AFFILIATED COMPANY, WINGET-SYNCRO, LTD., ROCHESTER, KENT, ENGLAND

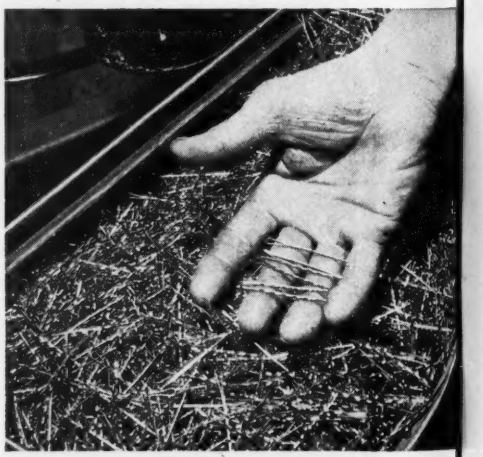
This is how Flamingo Products, Inc., receives wire shipped from Johnson Steel & Wire Co., Worcester, Mass. The 75-pound coils of half oval, bright finish, hard drawn wire are shipped in fiber drums lined with moisture resistant paper.

# Steel for Milady's Hair

**Problem: To produce 3 million bobby pins daily, each with the right amount of spring, color and ease of opening, takes special steel wire and high speed equipment. Here's how one producer does it.**

A new coil is placed on a pin forming machine which will cut the wire to proper length, bend it back on itself, crimp one side with five bends and give one tip a "ski jump" bend.

Heart of the bobby pin manufacturing process is the forming machine shown above. The output of a few minutes on a single machine will fill a large tray.



The formation of bobby pins on high speed machines calls for wire of uniform quality. The stresses the wire undergoes in assuming its final shape demand high standards.

Heat treating is necessary to relieve the stresses set up in the wire by the severe deformations the wire undergoes in the bobby pin forming machines.

Packaging is precise at Flamingo Products, Inc. Here Mrs. Frances Bradfield demonstrates how a battery of girls box the finished bobby pins.

**Consider the bobby pin. It presents a tough manufacturing problem for it weighs only 1/100th of an ounce and costs less than a penny.**

Women stick about 10,000 tons of bobby pins into their hair each year, yet the average bobby pin has a very short life before it disappears—where, nobody knows.

You might think that such a small item, which sells for so little and has such a short life expectancy, would be produced in large quantities without much regard for close tolerances or uniformity.

**Bobby pin manufacture actually is a very precise, closely controlled operation that requires very high quality steel wire of consistent uniformity. That's where Johnson Steel & Wire Company fits into the picture—supplying leading producers with uniform wire that has the chemical composition and physical properties to meet exact specifications.**

The quality of the wire is all important to the economical production of high quality bobby pins. If the wire is too soft, it will lack the springiness and clamping action which a bobby pin must have. If the wire is too hard, it will break in the bobby pin forming machines and cause costly production delays. If it isn't the correct half oval or flat shape, it won't go through the forming machines.

**Take a look at how one producer, Flamingo Products, Inc., Danville, Illinois, uses this wire, and you'll appreciate how much is involved.**

**Heart of the bobby pin manufacturing process is the forming machine,** which uncoils wire, coats it with kerosene for lubrication, straightens the wire, cuts it into proper lengths, bends it back on itself to form the characteristic bobby pin shape, crimps one side with five bends and tips one end into a "ski jump" so that the ends of the pin can be separated easily.

With each machine operating at the rate of 250 pins per minute, a battery of pin forming machines can produce around three million pins a day. One machine forms about 95,000 bobby pins out of a 100-pound coil in about six hours.

**Heat treating is necessary to relieve the stresses set up in the wire during the forming process. Enameling, or electroplating, gives bobby pins protective coatings, which match the various shades of women's hair. Finally, the tips are given a special dip coating of polyethylene plastic which is baked and cured.**

**Rigorous testing completes the cycle.**

**Wire made by Johnson Steel & Wire Company for bobby pin manufacturers is a tailor-made product.**

Flamingo, for example, gets a bright finish, hard drawn, high carbon wire, which is rolled to a half oval or flat shape before it is shipped from the mill in fiber drums lined with moisture resistant paper. The wire is .055 inch wide and .022 inch thick. Plus or minus tolerance on width is .002 inch and only .0005 inch on thickness.

Other Johnson products cover a wide range of wire specialties including: Aircraft Cord Wire . . . Armature Binding Wire . . . Belt Hook Wire . . . Brush Wire . . . Gutterbroom Wire . . . Card Wire . . . Shade Roller Wire . . . Flexible Shaft Wire . . . Heddle Wire . . . Hose Reinforcement Wire . . . Hose Wire . . . Mandolin Wire . . . Piano Wire . . . Rope Wire . . . Safety Pin Wire . . . Special Shaped Wire . . . Staple Wire . . . Metal Stitching Wire . . . Signal Corps Wire . . . MB Spring Wire . . . Music Spring Wire . . . Tire Bead Wire.

**If you have an application which requires uniform high quality wire made to close tolerances, Johnson is ready to serve you. Why not call your closest district office today?**

# Johnson Steel & Wire Company, Inc.

**Worcester 1, Massachusetts**

**PLANTS:** Worcester • Akron • Los Angeles **WAREHOUSES:** Worcester • Chicago • Los Angeles

*a subsidiary of* **Pittsburgh Steel Company**

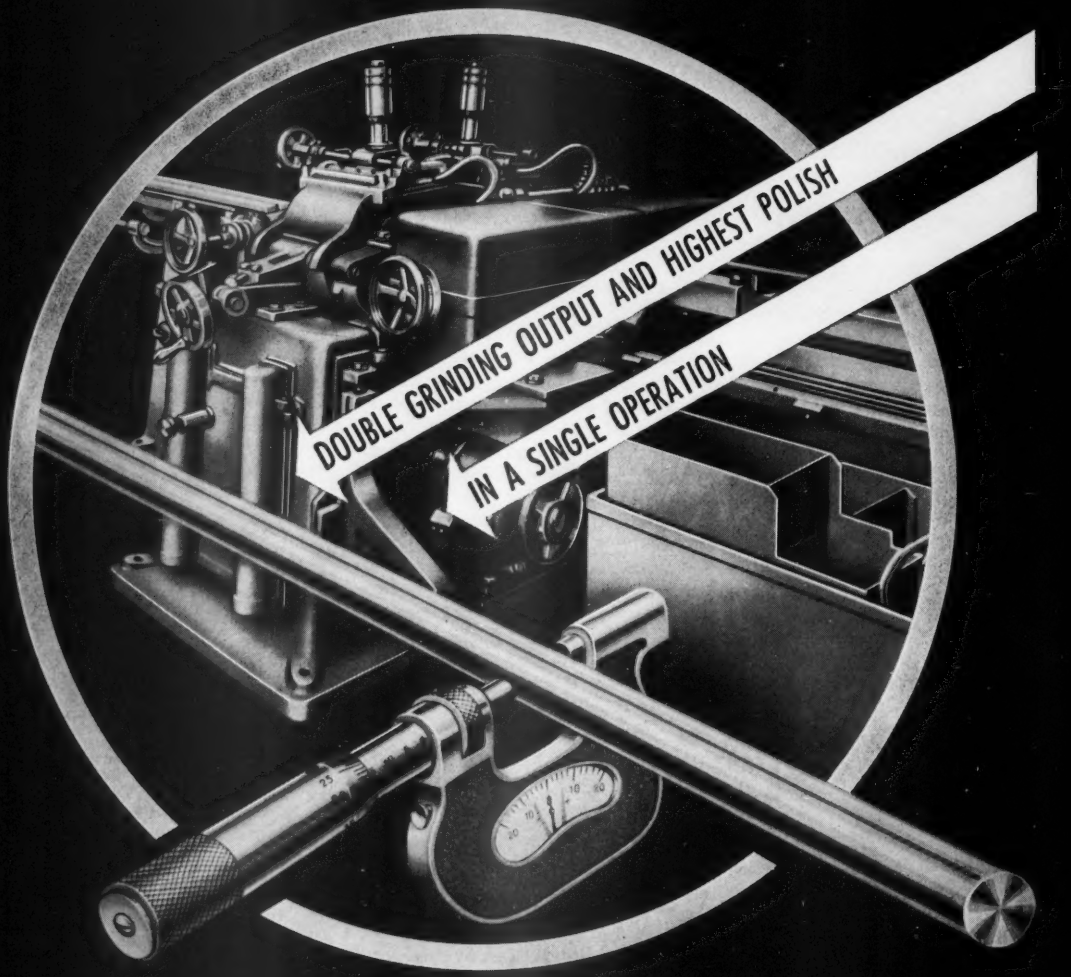
**Grant Building • Pittsburgh 30, Pa.**

**DISTRICT SALES OFFICE: Akron • Atlanta • Chicago • Cleveland • Columbus Dallas • Dayton • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Tulsa • Warren, Ohio. PLANTS: Monessen, Pa. • Allenport, Pa. • Akron • Los Angeles • Warren, Ohio • Worcester, Mass.**

# SCHUMAG AACHEN

GRAPHIX JUPP KUCKARTZ

## CENTERLESS BAR GRINDING AND POLISHING MACHINE




EXCLUSIVE REPRESENTATIVES FOR USA, CANADA & MEXICO
**American Laubscher Corp.,**
Fisk Bldg., 250 West 57th Street, New York 19, N.Y.

# There's room for greater profits

*. . . with the NEW Torrington W3001*

**TORSION SPRING WINDER**

*Room* — room in which to work — is the outstanding feature of Torrington's new torsion spring winder. This modern, high production machine actually provides the largest tooling area ever devised. In addition, the W3001 offers many other advantages which will help spring-makers boost their production of torsion springs and reduce their costs at the same time.

*• Tooling area measures 12" by 18" • Tooling is faster and easier • Tools themselves can be made sturdier and more durable • Shafts on 3 sides plus vertical 2-slide attachment give great versatility in producing complex forms • Capacity extends to 10 turns of .080" wire, thus meeting the great majority of customer requirements for torsion springs • Rugged design means years of trouble-free operation with minimum downtime for maintenance and repairs.*

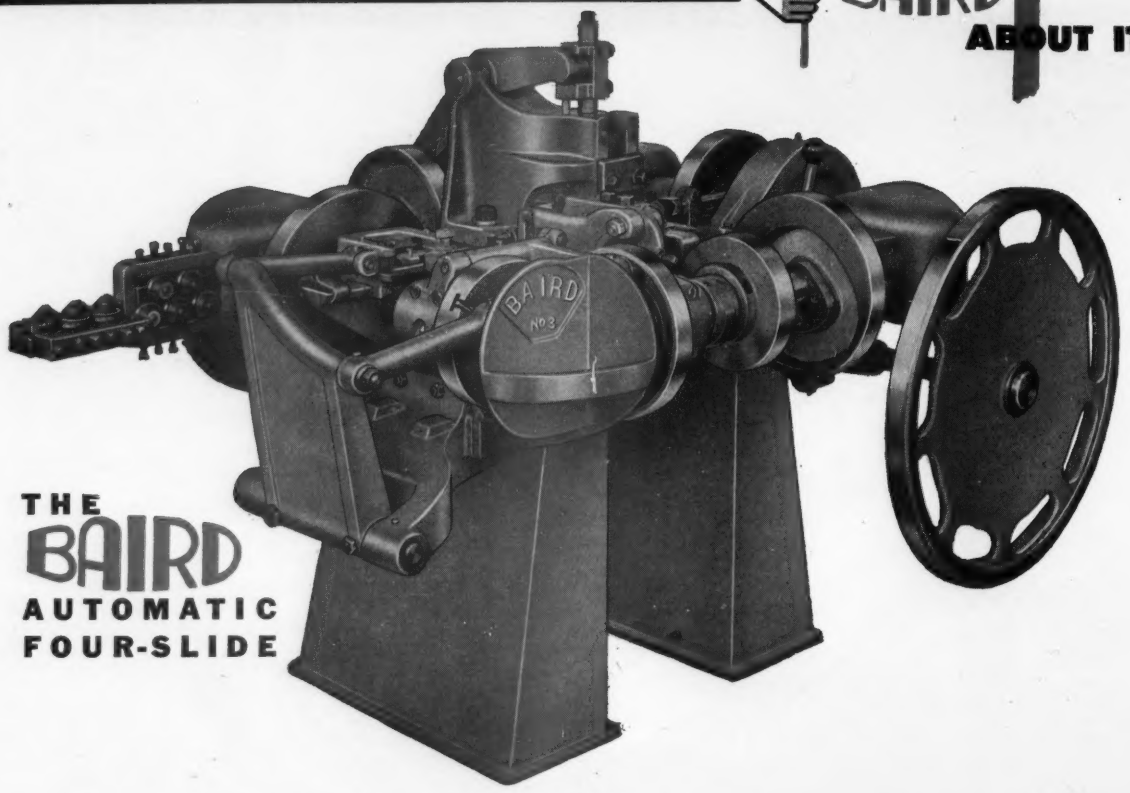
The Torrington Manufacturing Company has built more spring coiling machinery since 1937 than all other manufacturers combined. The knowledge and skill gained while serving spring makers during this period has now been used to create a torsion winder which we firmly believe is the finest ever offered to the industry. If you manufacture torsion springs, this new machine will give you faster, more efficient production and unprecedented versatility to meet your customers' most exacting needs.

Call or write, *now,* for full information.

THE
**TORRINGTON**
**MANUFACTURING COMPANY**
TORRINGTON · CONNECTICUT
WIRE FORMING MACHINERY DIVISION

. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT




THE BAIRD AUTOMATIC FOUR-SLIDE

## NO MACHINE IN THE WORLD CAN MAKE A GREATER VARIETY OF PARTS . . . *OR PRODUCE THEM ANY FASTER*

Yet, new wire shapes, formed *by hand,* are continually submitted to us for tooling setups to produce them *automatically* on Baird Four-Slide Machines. We usually solve the problems.

Coiled wire is taken from a reel, is straightened, fed and cut off to the required length . . . then formed and ejected as a remarkably accurate part. The per-minute speed of production is almost unbelievable . . . and the unit cost likewise.

You may purchase your machine tooled for specific repetitive production, then add other tooling and attachments as required to increase the versatility of production of both wire and metal ribbon articles to the greatest degree.

Various sizes of standard machines give you a selection of wire lengths to 32½" . . . dia. to ½" . . . or flat ribbon metal products to 1½" wide.

Baird engineers will develop your tooling from your parts or from blueprints. The Baird Four-Slide Bulletin (Wire or Ribbon Metal) will open new avenues to low-cost competitive production. Your copy on request—write Dept. WP.

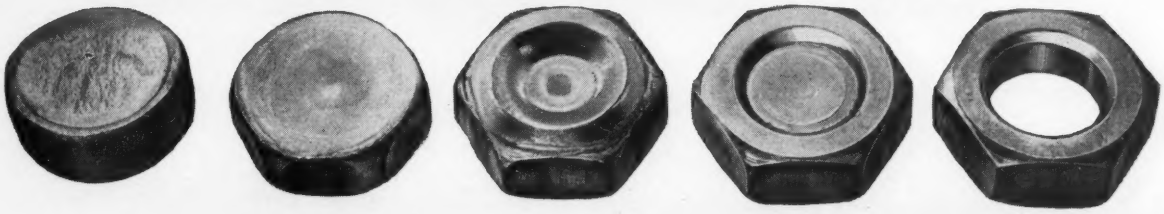
THE BAIRD MACHINE COMPANY
STRATFORD · CONNECTICUT

*WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:*

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

3BA55

# YOUNGSTOWN
## STEEL ROUNDS
### *used in manufacture of quality RB&W nuts*

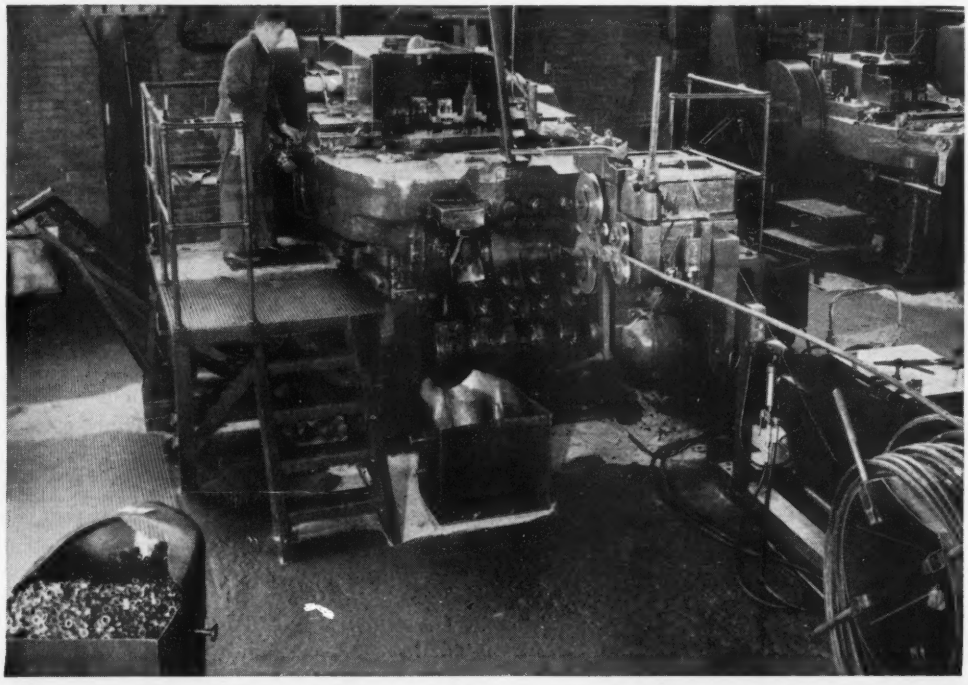


Russell, Burdsall & Ward Bolt and Nut Company pride themselves on the strength of their bolts and nuts. Justifiably, too, because they fabricate tremendous quantities of nuts from Youngstown Scrapless Nut Quality Steel. Not an ordinary steel, each step in making this Youngstown steel, from ore to the finished product, is closely controlled.

That's why, when nut formers punch and pound it, and when threading machines give it another going over, a nut made of Youngstown Steel comes through a winner. This material is free of injurious seams and also machines cleanly in the threading operation.

When you order Youngstown Scrapless Nut Quality Steel, either in Bar, Rod or Wire form, you can be sure it will be held to the right tolerances. Nothing less than perfection is the Youngstown policy.

The payoff for you will come in the form of your finished product.



**Five stages of nut making with Youngstown Scrapless Nut Quality Steel Rounds. Made by Russell, Burdsall & Ward, the end result shows what can be done with quality steel. The production machines are running smoothly at the Russell, Burdsall & Ward plants. Nuts by the millions are produced daily. Some are shown in the container in the foreground.**

QUALITY YOUNGSTOWN SERVICE

**THE YOUNGSTOWN SHEET AND TUBE COMPANY** *Manufacturers of Carbon, Alloy and Yoloy Steel*

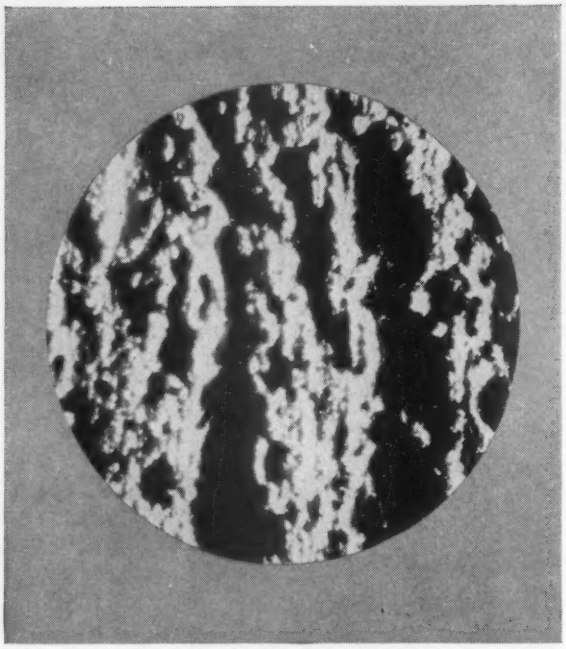
General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

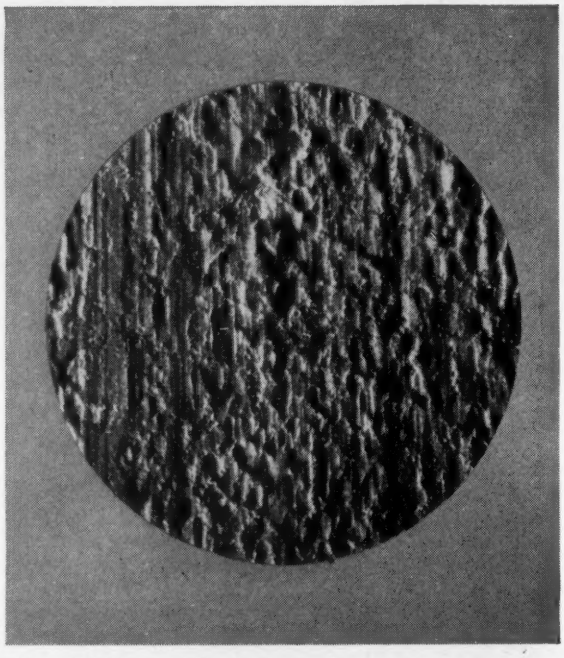
# HOW RODINE CUTS PICKLING COSTS

## Results demonstrate the effectiveness of Rodine® in retarding the attack of acid on the metal

Rodine pickling acid inhibitors, when added in small quantities to acid pickling baths, retard the attack of the acid on the metal without affecting its ability to remove scale. Their effectiveness in saving acid and metal is best demonstrated by this simple comparison.



**Effect of Uninhibited Acid on Steel** This microphotograph shows a piece of steel which was pickled in an uninhibited acid for 5 hours. Note the deep pits and the crystalline character of the surface of the metal.



**Effect of Rodine Inhibited Acid on Steel** This steel was pickled exactly like the other piece, but with Rodine added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred.

A typical strip pickling installation. Rodine prevents over-pickling even during line shutdowns.

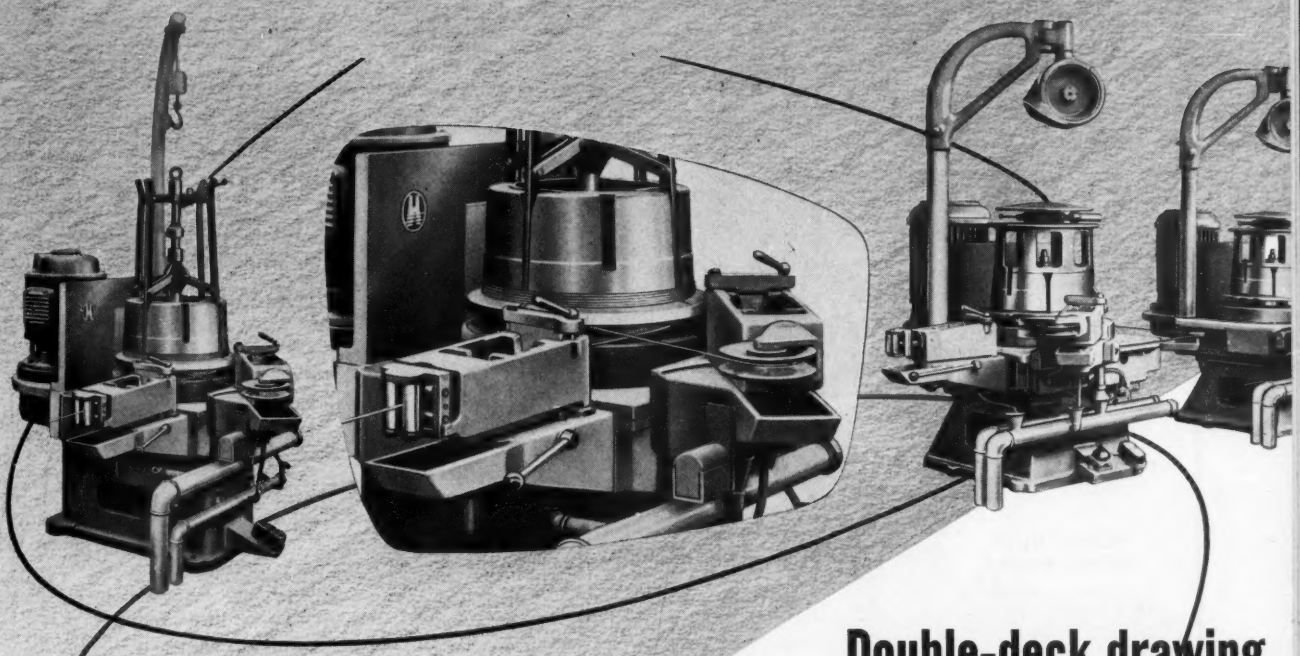
In straight line pickling of wire, rod and tubing, Rodine makes available more metal for drawing. In batch pickling, Rodine improves the surface. In continuous strip pickling, Rodine prevents overpickling during line shutdowns. Wherever it is used, Rodine saves acid and metal. Our treatise on pickling and the use of Rodine, "Efficient Pickling with Rodine," gives full information. Write for your copy today.

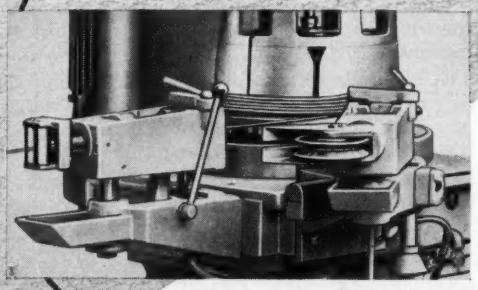
**AMERICAN CHEMICAL PAINT COMPANY**
**Ambler 30, Pa.**

DETROIT, MICHIGAN • NILES, CALIFORNIA
WINDSOR, ONTARIO

CHEMICALS ACP PROCESSES

# DON'T BE AFRAID OF DOUBLE-DECK DRAWING!





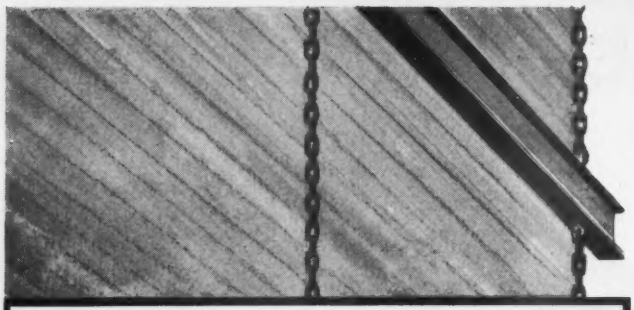
## Double-deck drawing

Views on the use of double-deck drawing for the cold forming of wire differs widely. It may therefore be useful to clarify when double-deck drawing should be used, and what its advantages are. When we speak of double-deck drawing, we refer of course to the dry drawing of wire.

When using a double-deck draft, slip on the first stage is naturally unavoidable, but the drafting of double-deck blocks can be so selected that it corresponds closely to the stages to be drawn on the machine, so that slip is reduced to a minimum. The best results with double-deck blocks are achieved when drawing carbon steel wire. This operation presents not the slightest difficulties. The same good results can be achieved on medium-gauge mild steel wire, from an inlet diameter of about 3.4 mm (0.134 in.) to finished sizes of 1.6 — 0.8 mm (0.063—0.031 in.). The wear on the first stage is negligible if the drafting is correctly adapted to the drawing stages, as described above. This information is based on experience gained in the operation of hundreds of double-deck blocks supplied by us. The outstanding advantages of double-deck drawing are:

1) it is much cheaper to draw wire on one double-deck block than on two single blocks
2) considerable saving in floor space as compared with single blocks
3) the compact arrangement is easier to supervise than long lines of single blocks

**MASCHINENFABRIK HERBORN** BERKENHOFF & DREBES A.-G. **HERBORN/DILLKREIS**
Sole Representative in the U. S. A.: GERMANY
**KURT ORBAN CO., Inc., 34 Exchange Place, JERSEY CITY 2, N. J.**

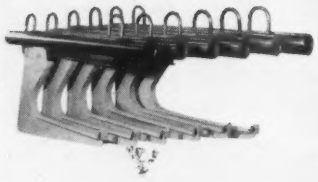


designed for the **tough** jobs . . .

# MONEL PICKLING HOOKS by LEWIS

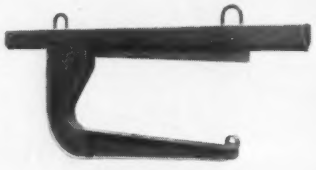
**STANDARD MONEL AND STEEL UNITS**

Two types . . . six sizes . . . load capacities up to 4,000 lbs. . . . replaceable steel spreader bars.



**HEAVY-DUTY MONEL HOOKS**

For heavy or extra long loads . . . supplied in range of sizes and capacities with steel or Monel spreader bars.



*Special design . . . extra-heavy construction . . . minimum maintenance costs* . . . these are the reasons why LEWIS acid-resistant Monel hooks give you more for your money.

These durable hairpin hooks feature a specially-designed drip trough on the load bar that picks up condensate and carries it out beyond the rod bundles. In addition, the all-welded Monel hooks are bolted to low-cost steel spreader bars that are easily replaceable at minimum cost.

Two types and six standard sizes of LEWIS pickling hooks are available. Load capacities range up to 6,000 pounds. (Hooks with greater capacities can be supplied on order.)

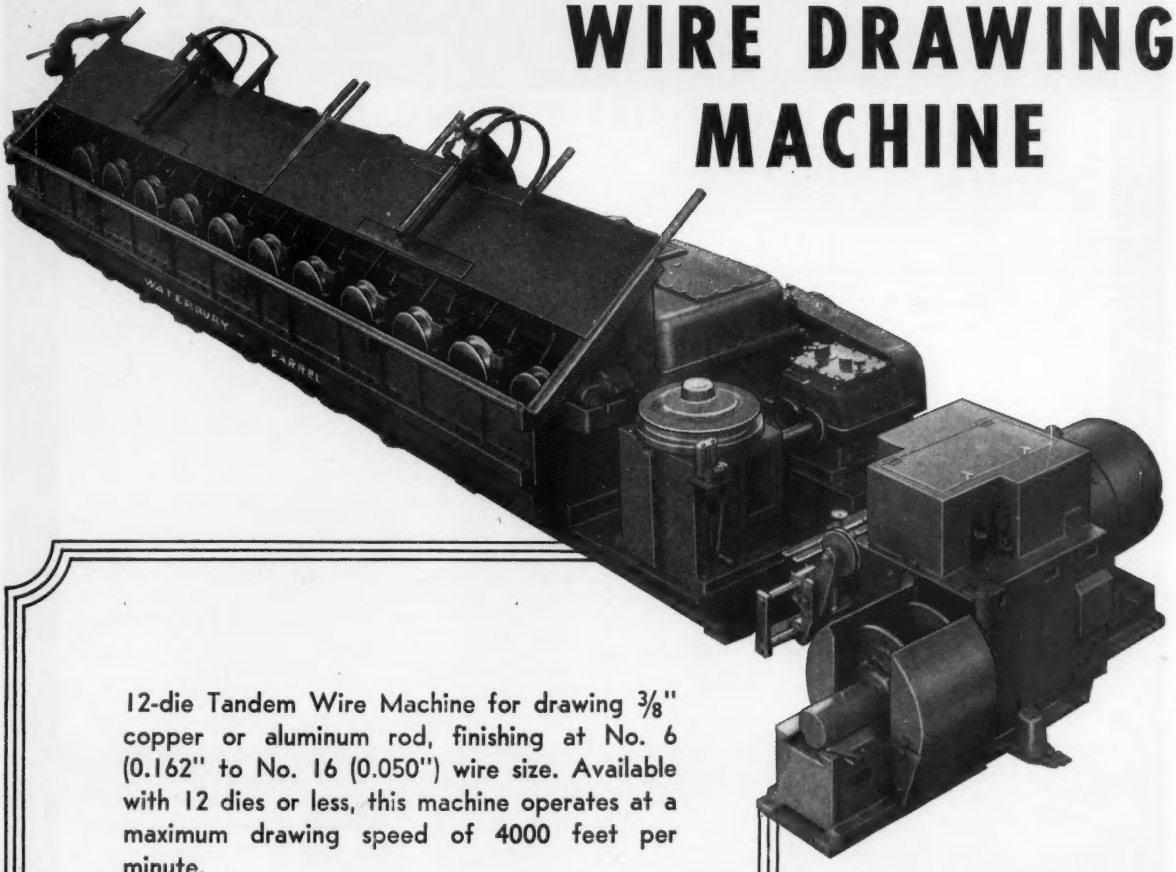
*For complete details and prices, write today . . . or call BEdford 2-2500.*

**THE LEWIS WELDING & ENGINEERING CORPORATION**

71 INTERSTATE STREET • BEDFORD, OHIO

# 4000 FEET PER MINUTE

## WITH THIS WATERBURY-FARREL 12-DIE TANDEM WIRE DRAWING MACHINE




12-die Tandem Wire Machine for drawing 3/8" copper or aluminum rod, finishing at No. 6 (0.162" to No. 16 (0.050") wire size. Available with 12 dies or less, this machine operates at a maximum drawing speed of 4000 feet per minute.

It can be furnished for drawing on spools, or coils, or as a combination machine for both as shown.

**IF IT'S MILL EQUIPMENT... *WE HAVE IT!***

**WATERBURY FARREL FOUNDRY & MACHINE CO. • WATERBURY, CONN.**

**Offices: Chicago, Cleveland and Millburn, N. J.**

*WIRE MILL EQUIPMENT*—Continuous Wire Drawing Machines (Upright Cone and Tandem) • Wire Flattening Mills • Chain Draw Benches • Pointers • Swagers • Bull Blocks • String-up Machines • Spoolers, etc. *COLD PROCESS BOLT & NUT MACHINERY*—Headers (all types) • Rivet Machinery • Trimmers • Thread Rolling Machines • Slotters • Nut Formers and Tappers, etc. *POWER PRESSES*—Crank, Cam and Toggle; also Rack and Pinion Presses • Eyelet Machines • Multiple Plunger Presses • Horizontal and Hydraulic Presses, etc. *MILL MACHINERY*—Rolling Mills: Strip, Rod, Wire Flattening, (For Ferrous and Non Ferrous Metals) • Also Slitters • Straighteners • Cut-off Saws • Coilers • Winders, etc.

FOUNDED WATERBURY FARREL 1851

# Monsanto PLASTICIZERS speed up processing, reduce production costs!

## MONSANTO PLASTICIZERS FOR VINYL-COATED WIRE

| TYPE WIRE | RECOMMENDED MONSANTO PLASTICIZER | ADVANTAGES |
|---|---|---|
| Type T and TW 60°C. UF-NMC Jackets | DIDP | Volatility ½ of DOP<br>Higher extrusion rate<br>Superior water resistance<br>Good electricals<br>Low pound volume cost |
| | DOP | High volume resistivity<br>Excellent uniformity of quality<br>Standard of the industry<br>Good electricals |
| SPT (lamp cords, etc.) | Santicizer S-160 | Low-cost primary plasticizer<br>Good electricals<br>Fast extrusion rate<br>Improves compatibility of secondary plasticizers |
| | HB-20 | Low-cost secondary plasticizer<br>Good color<br>Good electricals |
| 80°C. appliance wire<br>90°C. appliance wire | DIDP | High retention of elongation after extended heat aging<br>Good electricals |
| | TCP | Flame resistance<br>Low volatility<br>Grease resistance |

**Fast processing** and uniform quality are obtained with Monsanto plasticizers.

**Fast delivery** from bulk shipping stations in:

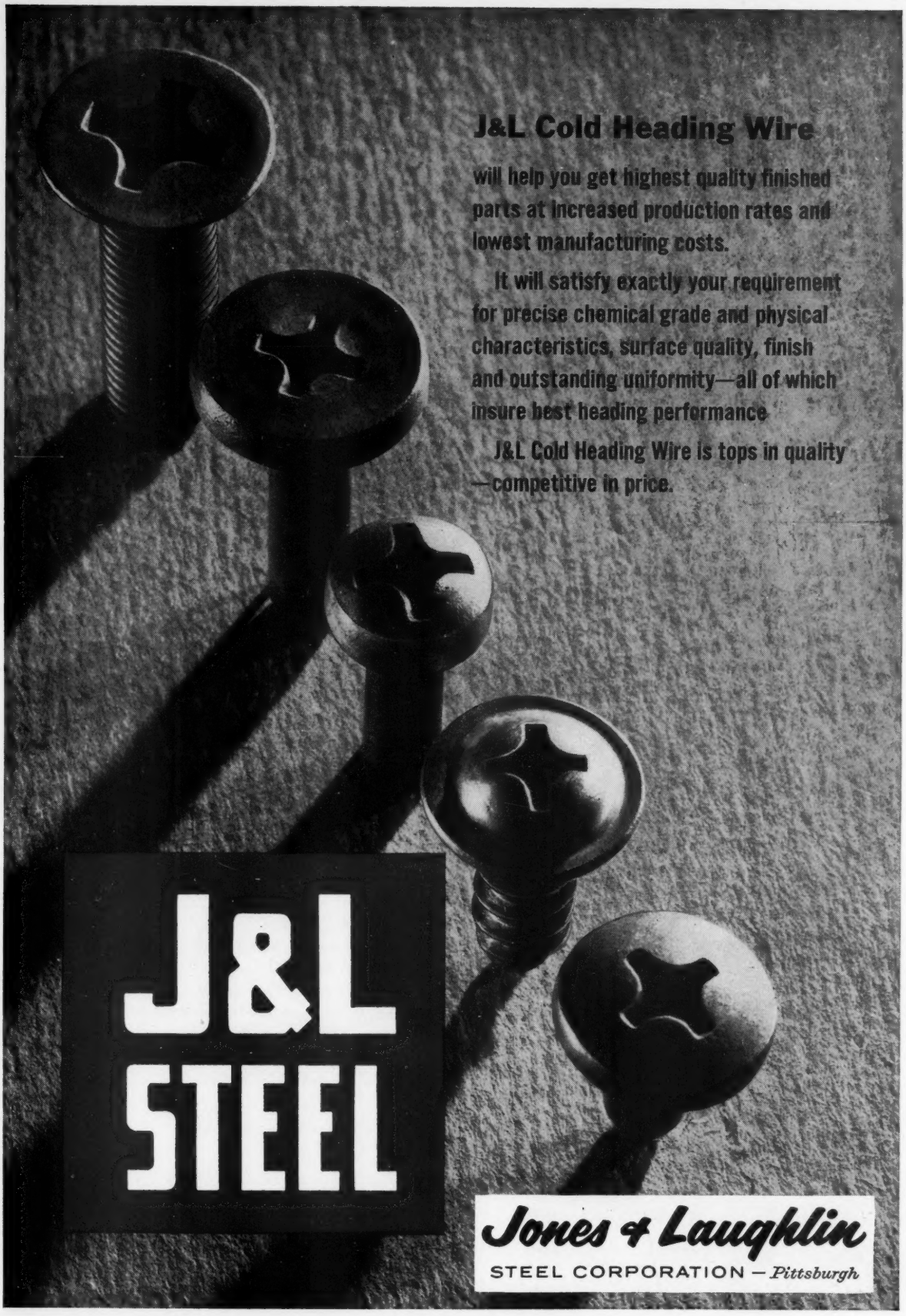
Everett, Mass. — Akron, Ohio
Perth Amboy, N. J. — St. Louis, Mo.
Greensboro, N. C. — Los Angeles, Calif.

For technical bulletins on DOP, DIDP, S-160, HB-20, and information about tricresyl phosphate, write: Plasticizer Sales Dept., Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-N-6, St. Louis 1, Missouri

SANTICIZER: REG. U.S. PAT. OFF.

MONSANTO
CHEMICALS — PLASTICS
®

SERVING INDUSTRY...WHICH SERVES MANKIND


J&L Cold Heading Wire
will help you get highest quality finished parts at increased production rates and lowest manufacturing costs.
It will satisfy exactly your requirement for precise chemical grade and physical characteristics, surface quality, finish and outstanding uniformity—all of which insure best heading performance
J&L Cold Heading Wire is tops in quality —competitive in price.
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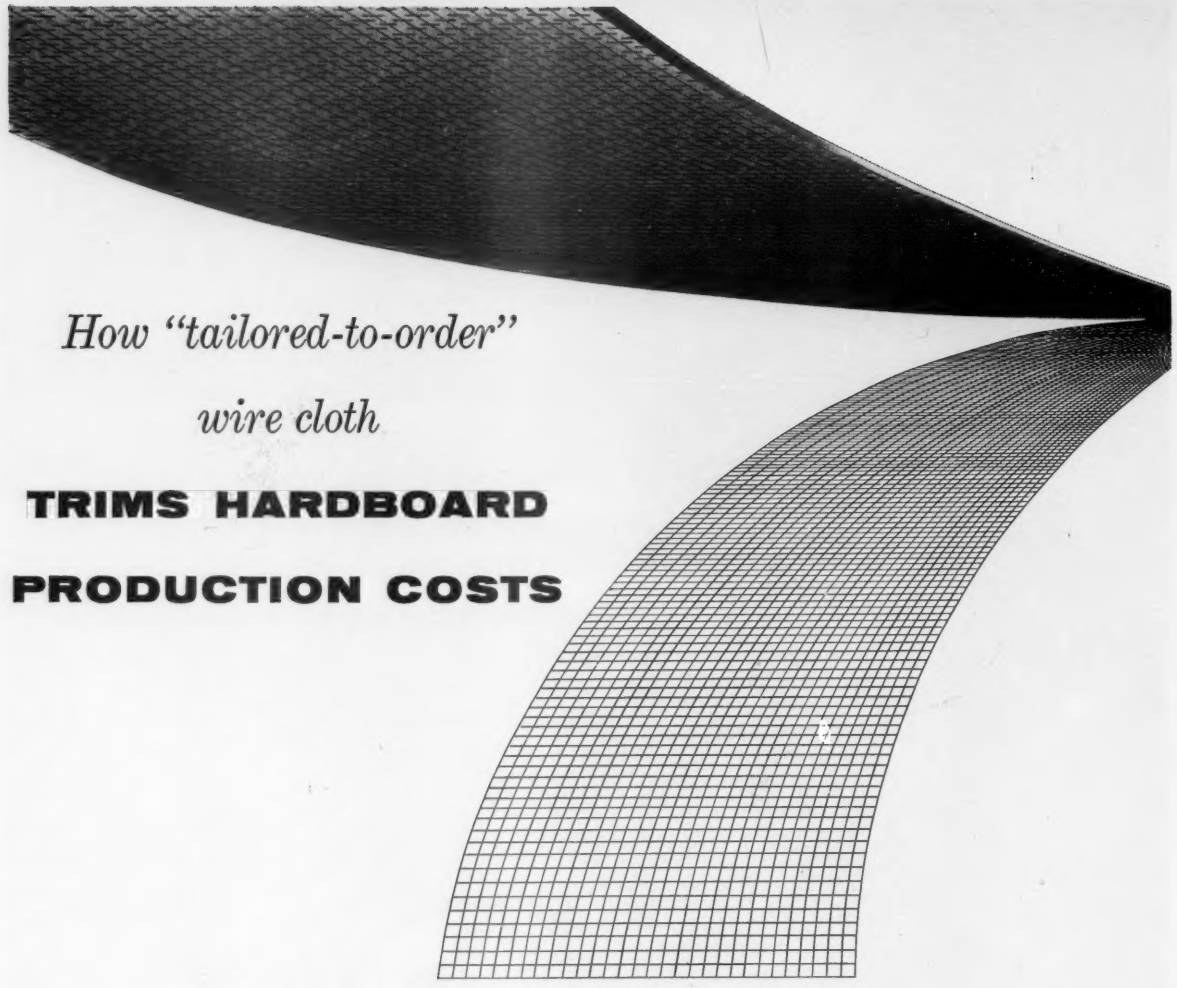
STEEL CORPORATION — Pittsburgh



*How "tailored-to-order"*

*wire cloth*

**TRIMS HARDBOARD**

**PRODUCTION COSTS**

• There's a tell-tale pattern on the back of a leading brand of hardboard. It was left there by a *new* kind of wire cloth, developed by the *Reynolds Wire Division* of National-Standard—developed because their customer had a problem which, as usual, Reynolds solved.

In this hardboard manufacture, wire cloth carries the heavy wet compound, supports the material during pressing, and pulls out the hardened boards, while being stripped away from the big boards by force. The stress is terrific! In fact there *was* no wire cloth that would hold up. It failed too often, requiring frequent replacement, slowing production and adding to costs.

But now all that is past . . . because Reynolds tackled the problem and came up with a radically new cloth construction. So unusual was the cloth that Reynolds even had to build special looms to produce it.

Here again is an example of the lengths to which Reynolds *often* goes to help customers save money, produce better products, or both! But problem or no problem, if you *use* wire cloth, or want to check on its use, you'll find Reynolds' kind of service and cooperation always pays off. Try us and see.

NS NATIONAL-STANDARD Company NILES, MICHIGAN

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Tire Wire, Stainless, Fabricated Braids and Tape

**ATHENIA STEEL DIVISION • CLIFTON, N. J.**
Flat, High Carbon, Cold Rolled Spring Steel

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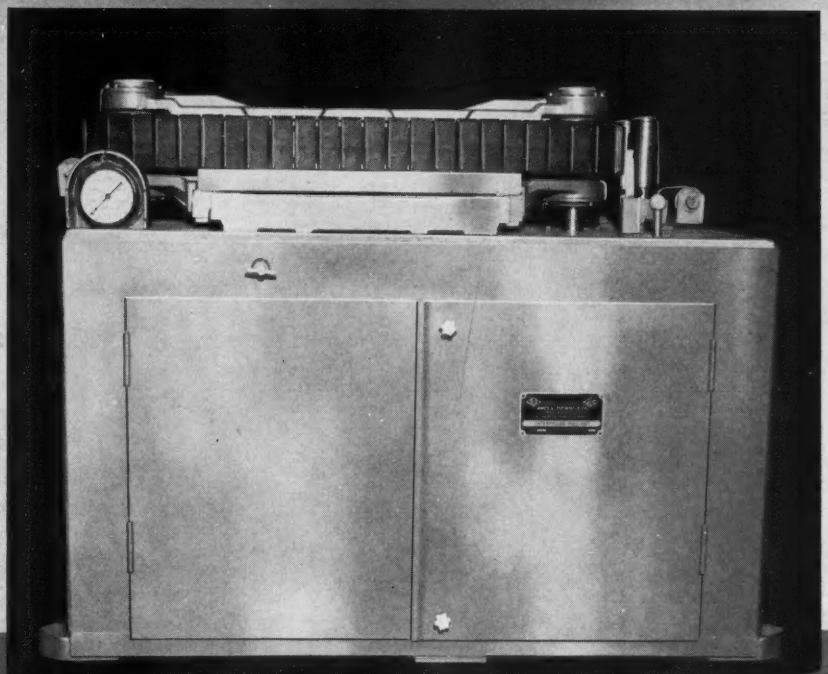
Special Machinery for Metal Decorating

**WORCESTER WIRE WORKS DIVISION • WORCESTER, MASS.**
Round and Shaped Steel Wire, Small Sizes

# DESIGNERS OF WIRE MACHINERY



## JAMES L. ENTWISTLE CO.

PLANT and EXECUTIVE OFFICE:
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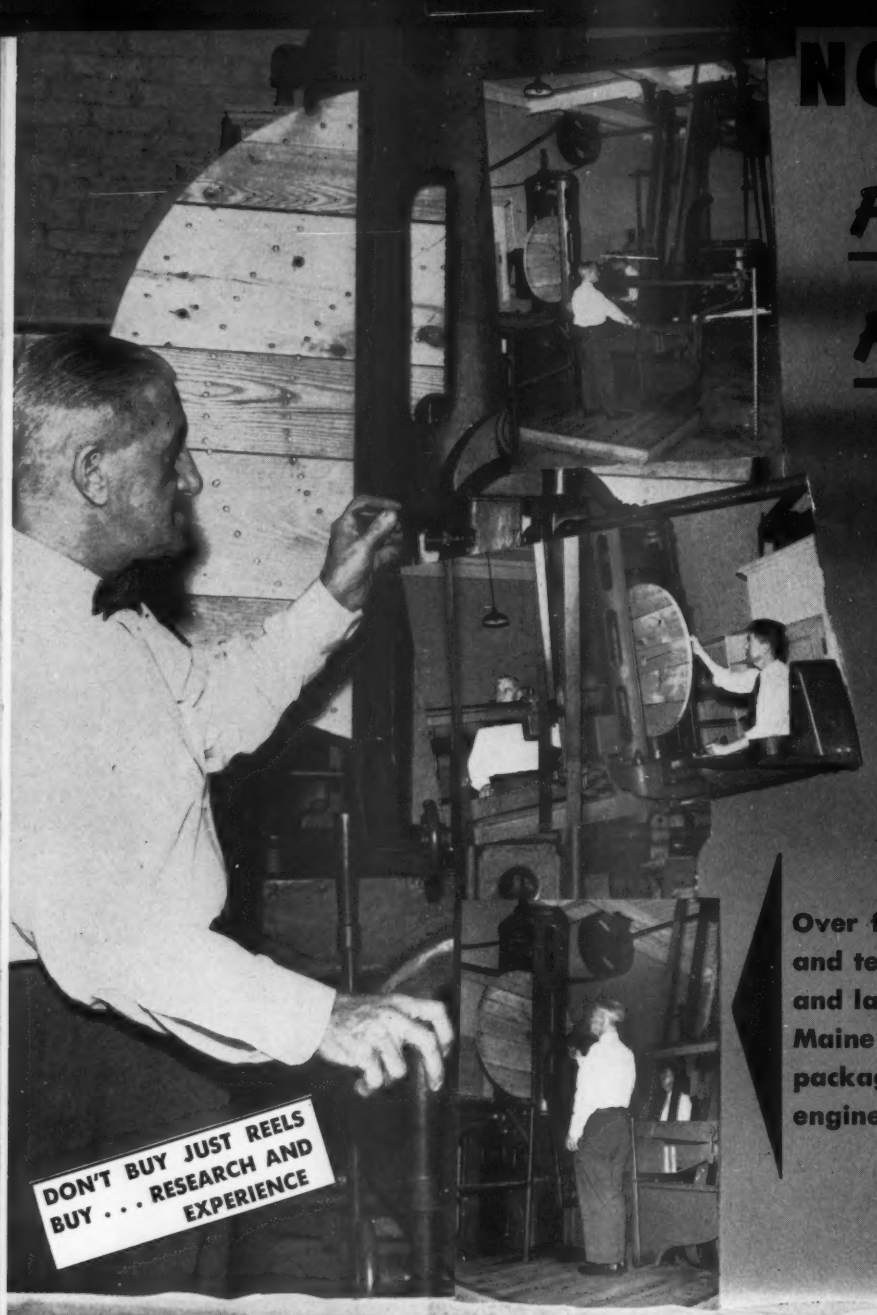
### "CATERPULLER" TYPE CHA

**A further development of the JLE Class C Caterpuller; an air-loaded Horizontal, Tractor-Type Pull-Out that replaces and out-dates capstans.**

FEATURES

- Quick opening, pneumatically operated treads receive cable. When closed, treads automatically apply any desired tension to cable.
- Air Cylinder applying tread tension is equipped with bleeder which allows variations in cable size to pass through without increasing pressure.
- Replaces and obsoletes capstan wheels as it does not bend or damage cable.
- Ruggedly constructed and completely enclosed; considerably reduces floor space required.
- Horizontal design makes loading easier, and is better adapted to higher operating speeds.
- Pressure on treads infinitely variable by means of air control valve to obtain pulling force needed.

ASK FOR CATALOG 16A.



# NORTH ANSON

**FIRST** with the solid and split steel ferrules

**FIRST** with metal bound reels 12" to 69" diameter

**NOW!**

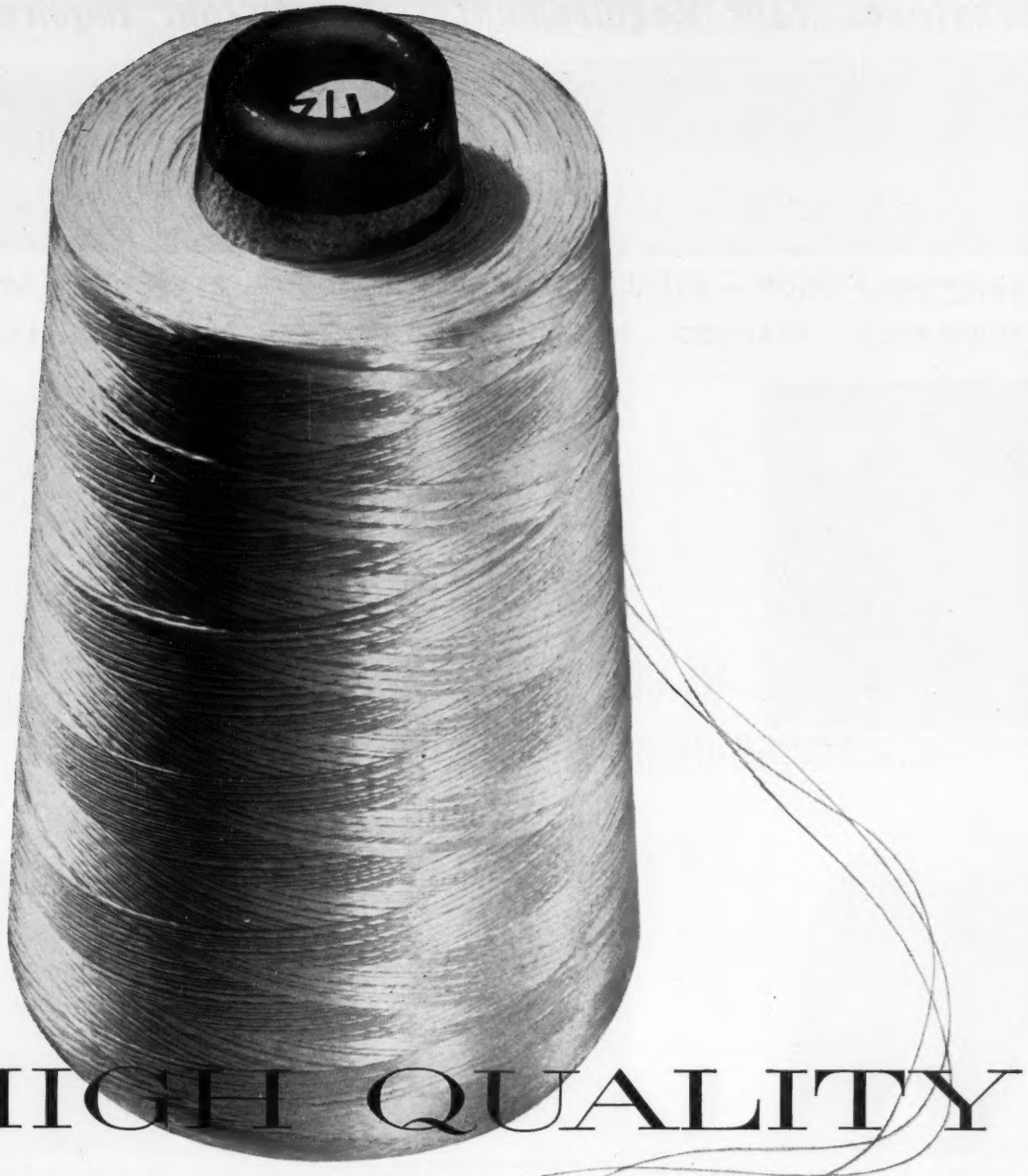
**FIRST** with a practical expendable reel

DON'T BUY JUST REELS BUY . . . RESEARCH AND EXPERIENCE

Over five years of exhaustive research and testing in conjunction with personnel and laboratories at the University of Maine has produced a NON-RETURNABLE package that is light in weight, soundly engineered and **LOW IN COST**

## NORTH ANSON REEL CO.

NORTH ANSON, MAINE . . . *Makers of Reels Since 1909*



# HIGH QUALITY

## *fiber glass yarns for wire and cable insulation*

Pittsburgh Fiber Glass yarns are made of exceptionally uniform continuous filaments, twisted and plied for any desired buildup. They are packaged for use with all standard types of serving and braiding machinery.

Pittsburgh yarns have proved their high quality with numerous manufacturers. If you have not yet put them to your tests, you are invited to make arrangements through our executive or district sales offices. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

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PITTSBURGH PLATE GLASS COMPANY

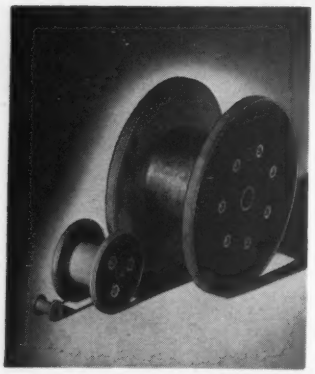
## *Whatever Your Requirements, Direct Your Inquiries to*

# HUBBARD—SPOOL and REEL HEADQUARTERS

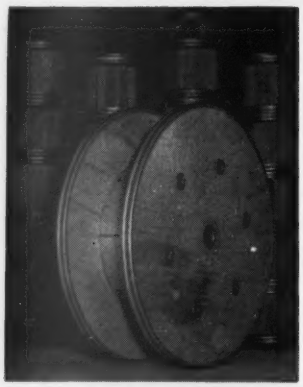
• ONE DEPENDABLE SOURCE FOR ALL TYPES •

**SHIPPING • SHOP • STEEL • ALUMINUM • WOOD • PLYWOOD • SPECIAL**

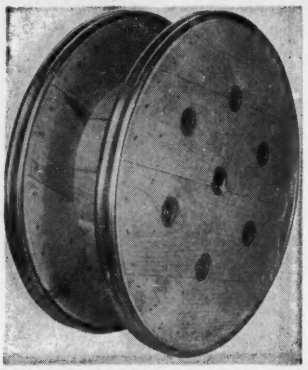
**TRAVERSES • FLANGES • CAST • ARBOR PLATES • WASHERS • LAGGING**



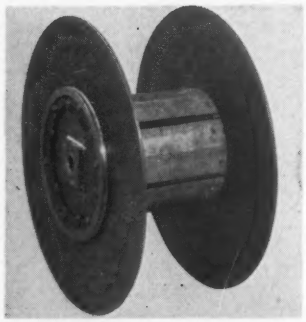
Plywood—Process and Returnable Shipping Reels.



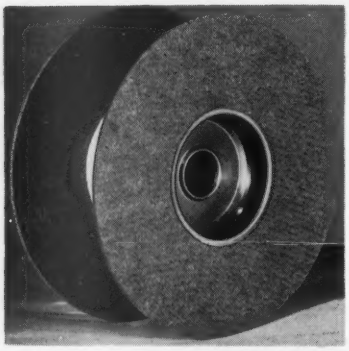
Dimension Lumber for Returnable Reels.



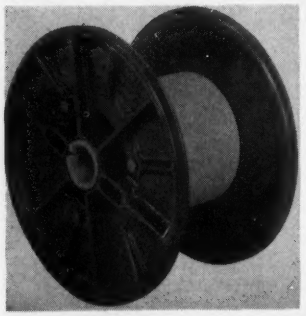
Nailed Reel. Banded for Returnable Types.



Special Reels Made to Your Designs



Reel with masonite flange and cardboard hub assembled with steel end washers for domestic or export shipment of wire, tape, braid or other materials.



Light Alloy Cast Reels for Process & Shipping

**The HUBBARD LINE of Spools and Reels includes all types and combinations of constructions for shipping, shop and processing for wire, rope and electric wire and cable, standard or made to your specifications.**

***We invite your inquiries.***

## HUBBARD SPOOL COMPANY

**GARRETT • INDIANA**

***Telephone: 840***

**"THE BIGGEST NAME IN SPOOLS AND REELS"**

## PROPERTIES OF KENNAMETAL DIE GRADES

| Grade | Hardness (Rockwell A) | Transverse Rupture psi | Young's Modulus of Elasticity psi | Compressive Strength psi | Suggested Applications |
|---|---|---|---|---|---|
| K82<br>K84<br>K86 | 90.0<br>91.0<br>91.5 | 275,000<br>300,000<br>250,000 | 65,500,000<br>74,000,000<br>72,000,000 | 663,000<br>600,000<br>590,000 | Draw dies (all sizes) for drawing tubes, bars and wire; for cupping and deep drawing. |
| K90 | 85.0 | 360,000 | 61,600,000 | 518,000 | Heavy blanking dies up to 3/16" steel. Dies for: cold-heading, nail gripping, nibbling, swaging steel rods, heavy curling, coining. |
| K91 | 86.5 | 380,000 | 64,400,000 | 540,000 | Light-heavy blanking up to 1/16" steel; rivet sets, crushing hammers, washers, dies. |
| K92 | 87.5 | 385,000 | 71,900,000 | 572,000 | Lamination dies on .004" to .035" silicon steel; medium blanking dies softer metals up to .040"; heavy forming dies; heavy heading machine hammers; hardware curling dies. |
| K94 | 90.0 | 325,000 | 77,900,000 | 600,000 | Tube swaging dies; light blanking up to .020" silicon steel; medium blanking, softer metals up to .040"; heavy forging dies; heavy heading machine hammers; curling dies for hardware. |
| K95 | 90.5 | 300,000 | 82,000,000 | 644,000 | Light blanking up to .015" silicon steel; light heading hammers; wear-resistant parts. |
| K96 | 92.0 | 250,000 | 94,300,000 | 800,000 | Dies for asphalt floor tile; slate-covered asbestos shingles; abrasive-covered roofing papers; and in the paper industry for slitter knives and plates; blanking and pressing dies; compacting dies for powder metallurgy, wear-resistant parts. |

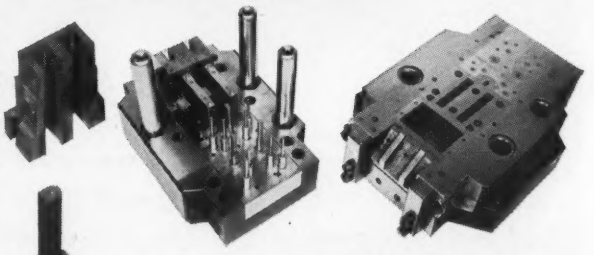
# You can select the right grade of Kennametal* for each specific die requirement

With six grades in the "90 series" and three grades in the "80 series," Kennametal offers the right grade for any die application. The 90 series covers the full range of tungsten carbide grade requirements—from K90 with exceptional strength for heavy operations to K96 with maximum resistance to wear for such jobs as compacting and cutting highly abrasive materials.

In the 80 series, Kennametal offers three exclusive grades with unique properties not found in any other carbide. These three $WTiC_2$ grades, with a special slippery quality, have been created especially for drawing, forming and sizing operations where the slightest amount of galling or pickup cannot be tolerated.

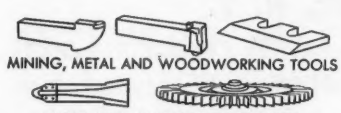
From these two groups you can select the right grade for each specific job to assure highest production rates, to reduce die cost and maintenance, and provide products of uniformly accurate dimension and finish. Kennametal die engineers will gladly work with you in analyzing your die operations. They can show you performance reports on Kennametal over a wide range of applications—many of which may be similar to your operations. Call your nearest Kennametal office or write us direct. If you wish more information, send for Booklet B-100 and a copy of our new die grade selection chart. Kennametal Inc., Latrobe, Pa.

*Registered Trademark

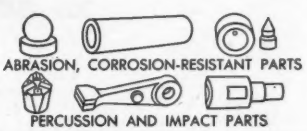


Use Kennametal Die Grades for blanking, stamping, compacting, perforating, cold heading, swaging, forming, cupping, drawing. Illustrations show a few of the many types of die parts made of Kennametal for producing a diversification of shapes to exact tolerances with a minimum of finish grinding.

7299




INDUSTRY AND
KENNAMETAL
...Partners in Progress



# DIAMOND POWDER RECLAIMING SERVICE

*ACCURATELY GRADED AND GUARANTEED*

## RECLAIMING

1. Send us your diamond-bearing waste. Our reclaiming department will salvage the diamond powders from wheels, sludges, hones, saw blades, cotton wastes or any type of diamond-bearing materials for you at reasonable prices.

2. These are cleaned, graded and returned to you for re-use—or, if you prefer, bought outright from you on the basis of the amount of diamond powder reclaimed. Your preference guides us.

## RECLAIMED AND VIRGIN POWDER SALES

3. The sales department has available from stock a full range of micron sizes, reclaimed or virgin, that are sold to you on a money-back basis as a guarantee of their accuracy of grading and quality.

4. Free samples are offered for your inspection in any size or sizes desired. These sizes range from 0-2, 1-5, 4-8, 6-10, 10-20, 20-40, and 30-60 microns, plus 400 and 325 mesh.

5. The service rendered to you by these two departments makes for an efficient and agreeable relationship between you and our factory. Your complete satisfaction with our products and service is assured.

*We invite your inquiries*

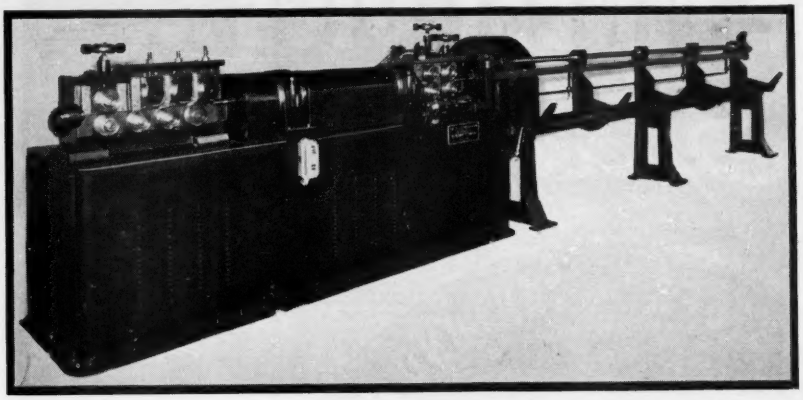
# KAY & WARREN COMPANY

**33 BOX STREET • BROOKLYN 22, N. Y.**

Reclaimers of

INDUSTRIAL DIAMONDS and DIAMOND POWDERS

# CONTROL IS THE GOOD WORD from SHUSTER



80 YEARS
SHUSTER
AMERICA'S OLDEST NAME IN WIRE STRAIGHTENING & CUTTING

**Dual Control 4AV** { Straightens and Cuts ¼" to ½" diameter basic wire

## *Individual Control of Speed and Cut Off*

**With the Dual Control 4 AV you can run at the most efficient speed for the characteristics of the wire being used. And you get a clean cut at any length. Send for details.**

### A COMPLETE LINE

***Constant Speed Machines*** **are available for straightening and cutting wire from .025" to ½"**

***Constant or Variable Speed Units*** **with electrically controlled clutch and target are available from 1/16" to ½"**

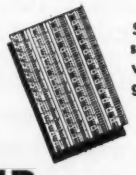
**Other variable speed machines may be furnished to straighten and cut wire up to 11/16"**

**ALSO**

***Slide Feed Straighteners*** **⅜" x 10"; 9/16" x 10"**
***Feed Starters*** **maximum ⅝" diameter**

***Tube and Bar Straighteners*** **7/32" to ⅝" bar; 1" tubing**

***Reels*** **for coils up to 300 pounds**



**Send for free, wall-size, split-gauge wire chart, from 41 gauge to 7/0.**

# SHUSTER

**Since 1866**

# METTLER MACHINE TOOL, INC.

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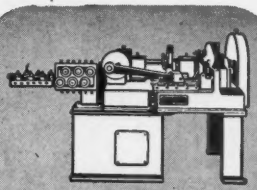
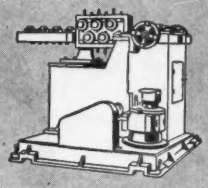
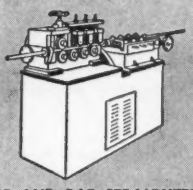


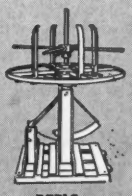
**SLIDE FEED STRAIGHTENERS**
**3/8" x 10"; 9/16" x 10"**



**FEED STARTER AND STRAIGHTENER**
**Max. 5/8" dia.**



**TUBE AND BAR STRAIGHTENER**
**7/32" to 5/8" bar 1" tubing**



**REELS**
**400 lbs.**

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Gentlemen:

Please send us your recommendations. Our straightening and cut-off requirements are as follows:

.....

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Name .....

Firm .....

Street .....

City ..... Zone ..... State .....

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# For the FINEST Dies...

*Specify*

## There Are Many Reasons Why V-R Leads The Field!

V-R NEW Cylindrical nib and improved method of assembly insure high degree of concentricity.

V-R . . . First in producing the only Tantalum-Tungsten carbide developed specifically for Drawing Dies.

V-R . . . First to manufacture Carbide Dies with preformed rough cored back relief.

V-R . . . First to furnish Carbide Dies rough cored to finish at hole sizes below .010".

WRITE TODAY for NEW Vascoloy-Ramet Die Catalog VR-461.

The New V-R Die Catalog gives complete ordering information on all V-R Dies for drawing wire, rod, bar and tube.

**Vascoloy-Ramet CORPORATION**

898 MARKET STREET

WAUKEGAN, ILLINOIS

# The Wire Outlook

Two major props to prosperity have been automobile sales and building construction. Their soaring sales, however, have created some question in the minds of credit men as to soundness of the volume of business represented by paper.

Clearing out the old models to make way for the new caused sales to top those of July, 1954, by $500,000,000. The installment debt is 2¾ billions higher than a year ago, and production for 1955 will come close to 8 million units. The previous high was in 1950, when 6,665,000 cars rolled off the assembly line.

Building construction will account for approximately 1.3 million units this year, of which private homes are a big part. Construction spending will total $41 billions in 1955, a large part of which is represented by home mortgages. This year will be the seventh consecutive one in which over one million buildings have been erected.

Credit men may be pardoned for watching the rise in installment buying with bated breath, in spite of the fact that disposable personal income and employment are at all-time highs. The incomes of businesses, businessmen and wage-earners is rising, although farm prices and income are falling. This downturn has been disturbing both to farmers and economists, because the prices they have to pay for farm equipment is going up constantly. This trend has been apparent for nearly five years, and is probably a good illustration of the inability of man-made provisions to bolster prices and keep them high.

With all the doubts about credit and inflation, 1955 is going to stand out as the best, brawniest and brightest period of over-all prosperity in our nation's 179-year history; this good business is expected to endure during the coming year.

The President's illness has been a matter of grave concern to all. The market reacted to the news with a sharp drop in security prices. Confidence in the soundness of our economy and our progress toward world unity had never been higher and the fear that the President's attack might lead to an administrative change was unsettling.

No one man is indispensable, yet it is perfectly natural to want to see a leader continued in office whose policies have instilled such extraordinary confidence among businessmen and the people. It is unthinkable to contemplate a return to the days of handouts, persecution and extravagance, all designed to secure the votes of the masses.

The supply of aluminum, due to unprecedented demand, has tightened considerably, so much so that the ODM recently diverted to industry 75,000 tons, destined for stockpiling, to avert a shortage.

Backlogs on steel bars are piling up because of a shortage of raw steel and consumers are beginning to worry about their 1956 allotments. However, big steel companies feel that the supply will be better by the year's end.

With the growing trend toward the use of coil springs in bedding, the bed spring industry is enjoying a boom. It now is taking about 365,000 tons of steel wire annually to provide the country with comfortable mattresses.

High carbon wire specialties, cold heading, bright and spring grades of wire are selling well, with orders extending into 1956 for deliveries. Automotive manufacturers are building up spring stocks against an anticipated heavy production schedule on the new crop of cars. Merchant wire continues weak. Wire operations should be at capacity for the balance of the year.

Here is how it looks now for 1956: there will be a levelling off of business toward the end of this year; the new year will carry along at current levels with no further spurts; there may be a seasonal dip in the summer; and in the autumn, business will pick up again gradually. Stability, rather than a boom, is expected to characterize 1956.

There won't be much excuse for anyone not to keep busy.

—from the Editor's Desk

**1** **Co-ordinated research, development and production**

. . . careful control of manufacture, through continuous research and testing, insures uniformity of all Steelskin products.

**2** **Warehousing-in-stock supply**

. . . guarantees an adequate supply of the Steelskin products you need at all times — preventing possible production slow-down.

**3** **Dependable performance**

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Vol. 30 November, 1955 No. 11

# The Effect of Cold Reduction On Some Properties of Nickel Wire

by Glen A. Nelson
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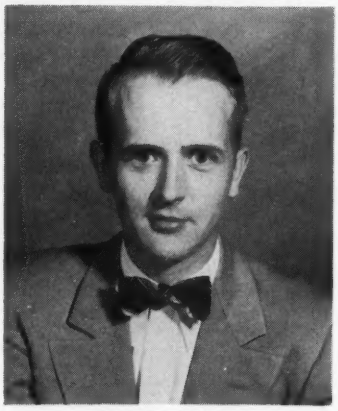
**Everyone** who is involved in the manufacture or use of non-ferrous metals and alloys in present day industry is aware of the continuously increasing requirements placed on the performance of these materials. Not many years ago manufacturers would have scoffed at specifications which are commonplace today. This then is what we call progress; progress in metal working techniques, progress in methods of testing and, in back of both and making both necessary, progress in design.

## Industrial Requirements

**Advanced** requirements have been particularly noteworthy and fast moving in the electronics industry, where the demands of the military, of industry and of the general public for more intricate, more reliable and smaller equipment and components are ever increasing. The challenge which has been thus presented has been met, in general, very well. Playing a large part in the whole picture, of course, has been the wire drawing industry.



Glen A. Nelson

**The author was graduated from the University of Michigan in 1943 with the degree of B.S. in Chemical Engineering. After graduation he was employed on the Manhattan Project and later with the Struthers-Wells Corporation on design of chemical process equipment. He joined Sylvania in 1950 as a process development engineer specializing in surface treatment and metallurgy of non-ferrous materials. He was appointed to his present position in June of this year. His paper was prepared for presentation at the Annual Convention of The Wire Association in Chicago, November 14-17, 1955.**

**Wire,** in general, is taken for granted by many. Yet a large part of miniaturization, for example, has been dependent upon the ability of the wire drawer to maintain extremely close control on the properties of his product. Not only must the diameter be controlled in many cases to less than ± 0.0001" but just as strict limits have been placed on the mechanical properties and the chemical composition of wire products. It must also be realized that these properties are often inter-related in one way or another. In nickel the chemical composition is very important in the control of the mechanical properties of wires processed in a particular annealing cycle. Slight differences in chemical and mechanical properties are also known to effect die wear under certain conditions and thus make practical dimensional control of the wire product difficult or nearly impossible.

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**Because** of increased demands for closer control of the properties of nickel wires for electron tube applications, a study was undertaken to determine some of the

basic properties of various alloys of nickel in wire form. The purpose of this study was to investigate these properties particularly with respect to the effect of cold work, since such information did not appear to be readily available in the literature for the forms and compositions of material in question. The materials studied were "A" nickel, "D" nickel and "Perma" nickel. While these materials are basically pure nickels, they vary in the kind and amount of minor constituents which they contain and exhibit even greater variations in their mechanical properties and optimum methods of processing. Each is designed to fulfill a particular requirement.

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A comparison of the average chemical composition for the materials in question is given in Table I. Only those minor elements are listed which show significant variation from one material to another. Other minor elements such as iron, copper, silicon and sulphur are also present in small more or less constant amounts in each of the three materials.

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One may wonder about the applications of materials whose compositions are so nearly similar as those shown in Table I. A large number of the differences are peculiar to the field of electron tube manufacture. Electronic grade "A" nickel is a commercially pure nickel produced by melting and deoxidizing electrolytic nickel. It is particularly applicable in wire form to electron tube support wires and rods, grid side rods and base pins, since it has a high order of corrosion resistance, sufficient strength to withstand the high temperature to which it is exposed during outgassing in the tube manufacturing process without deforming or sagging, and has a sufficiently low specific resistivity (about 57 Ohms per circular mill foot at 32°F) to permit its use as a current carrying lead. "A" nickel is, however, very sensitive to intergranular attack when exposed to minute quantities of sulphur which may sometimes be present in annealing atmospheres or in the gas flames used to seal glass in the tube manufacturing operation.[1]

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"D" nickel on the other hand, because of its high manganese content, has a higher tolerance to sulphur contaminated atmospheres and, therefore, is more suitable for uses such as in glass seals where flame sulphur attack may be a factor. However, because of the manganese content it oxidizes somewhat more readily than "A" nickel. "D" nickel also has a slightly higher strength and base hardness when fully annealed, as well as a higher annealing temperature. A particular application for "D" nickel is for grid lateral wire, since its electron emission is much lower than that of "A" nickel. Grid lateral wire may be described as the very fine wire wound laterally around two support wires and placed between the plate and cathode of an electron tube to control the flow of electrons between these two elements. The electrical resistivity of "D" nickel is about 110 Ohms per circular mill foot at 32°F.

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**TABLE 1**

**COMPOSITION OF NICKEL ALLOYS COMPARED**

| Material | Nickel & Cobalt (Ni & Co) | Manganese (Mn) | Carbon (C) | Titanium (Ti) |
|---|---|---|---|---|
| "A" Nickel | 99.0% min. | 0.35% max. | .20% max. | – |
| "D" Nickel | 93.7% min. | 4.5% – 5.0% | .20% max. | – |
| Perma Nickel | 97.0% min. | 0.50% max. | .40% max. | 0.2% – 0.6% |

"Perma" nickel, while it appears to have a composition much closer to "A" nickel than does "D" nickel, exhibits the most difference in hardness, workability, annealing characteristics and mechanical properties. The small addition of titanium and the increase in carbon content combine to make this alloy a precipitation or age hardening alloy. It has high strength, high corrosion resistance and requires much higher annealing temperatures than either "A" or "D" nickel. A water quench is required in order to obtain maximum softness. Precipitation hardening takes place when the material is heated to temperatures between 900 and 950°F.[2] Typical applications for this material in electron tubes are as grid lateral and grid side rod wires, particularly where very small closely wound grids with maximum rigidity and freedom from vibration are required.

## Definition of Mechanical Properties

At this point it may be well to clearly define the various mechanical properties as they are considered in this paper. The properties studied are tensile strength, yield strength, working range and elongation. Tensile strength is defined as the load per unit area at which the specimen breaks under tension. No differentiation between tensile strength and breaking strength is made since both points are coincident for the materials under consideration. The definition of yield strength differs somewhat from the usual since here the yield strength is considered to be the load per unit area applied which causes a one percent elongation in the specimen. The usual definition of yield strength is the load per unit area applied at the point where the specimen is permanently deformed. However, the use of the one percent figure was established in the electronics industry many years ago to facilitate the standardization of test procedures and because test equipment was not available which would read accurately below this point.

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The term "working range" is also somewhat peculiar to the electronics industry. It is defined as the difference in load per unit area between the yield strength at one percent elongation and the tensile strength. It represents the range of loads which may be applied to a wire between the point

where it is permanently deformed and the point where rupture occurs. This property is considered very important particularly in the winding of electronic tube grids where tube characteristics are dependent on holding very close tolerances in grid shapes.

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**The** term "elongation" is familiar to all in the metal working field. On wire samples it is considered to be the increase in length of a specimen from the initial length to the length at which rupture occurs expressed as percentage increase in the original length.

## Experimental Data

**The** data presented here were obtained by cold drawing small diameter wire samples through standard wire drawing dies for various amounts to reduce the cross-sectional area by predetermined percentages. When more than one pass was required, a standard reduction of 20% was used between dies wherever possible to arrive at the total desired reduction.

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**To** determine the effect of cold reduction on the properties of "A", "D", and "Perma" nickel wires, mechanical properties data were collected on wire samples drawn through various reduction ranges and on the same samples after annealing at various temperatures. By this procedure the effect on rates of recovery, the effect on grain structure, the effect of annealing temperatures and the uniformity of mechanical properties were studied. Two groups of samples were prepared for each of the materials investigated. The first group consisted of samples drawn through various reductions using .040″ diameter soft annealed wire as a starting material and finishing at various sizes depending on the reduction percentage. The second group consisted of samples drawn using soft annealed wire at an appropriate starting diameter to reach the desired reduction percentage and finish at a wire diameter of 0.005″.

**The** reduction percentages used in this investigation were in steps of ten percent between 10 and 60% and in steps of five percent between 60 and 95%. A maximum reduction of 98% was also investigated. No particular consideration was given to the selection of raw materials other than to assure that they were fully annealed and were of such chemical composition as to be within the specified range for their particular alloy type.

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**The** equipment used consisted of a laboratory wire drawing machine to pull the wire samples, a box type annealing furnace having a controlled atmosphere muffle volume of about two cubic feet and a Scott type incline plane tensile testing machine for the collection of mechanical properties data. Metallographic samples were prepared in the usual manner so that the grain structure changes resulting from various reductions and annealing treatments could be noted.

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**After** several samples of each group of wire were pulled through wire drawing dies to reach the desired percentage reductions, mechanical properties were measured on each sample. The resulting data were averaged for each degree of cold work and plotted as shown in Figure 1. A separate evaluation of the data obtained from material drawn from a constant starting size of .040″ and material drawn to a constant finished size of 0.005″ indicated that both sets of data were identical.

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**From** Figure 1 it will be seen that "A" nickel increases in tensile strength with cold reduction at a constant rate between 10 and 90%. A slight increase in rate is noted for values above 90%. The tensile strength for the alloy "D" nickel, which has a somewhat higher inherent tensile strength than "A" nickel, increases at a rate similar to "A" nickel between reduction values of 10 and 80%. It is interesting to note that the rate of increase in tensile strength with increased reduction rises sharply above 80%. "Perma" nickel when exposed to the same cold reduction treatment behaves in a somewhat different manner from the two preceding alloys. It shows a nearly linear increase in tensile strength between 10 and 95% reduction but shows a sharp lowering of tensile above 95% reduction. This point represented a gross separation of grain boundaries resulting in internal fracture of the samples studied. Perma nickel is shown to be an inherently harder material than either the "A" or "D" nickel alloys.

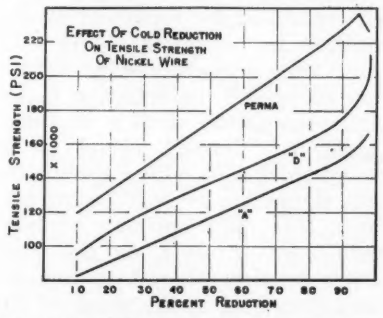


Fig. 1—The effect of cold reduction on the tensile strength of Nickel wire.

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**The** other mechanical properties of yield strength, working range and elongation were not considered in this part of the investigation since for reductions above 20% the yield strength was found to be equal to the tensile strength, the working range was zero and the elongation was below one percent for all specimens.

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**In** studying the effects of cold reduction on the properties of nickel wires, one must look very closely at the effects of such treatment on wire samples after annealing. The influence of reduction seems most pronounced in its effects on the recovery of mechanical properties after annealing. To evaluate this area it was necessary to carefully select the correct temperature and time of annealing for each of the alloys. Several annealing temperatures were tried with the time selected to insure that it was not a critical factor. It was observed that an annealing time of one-half hour was sufficient to arrive at a stable condition at any of the temperatures investigated and that in-

creased time beyond one-half hour had little effect. Annealing temperatures which were lower than those required to produce maximum softness of the specimens were of most interest since they appeared to best reflect the effects of differences in cold reduction on all three alloys.

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**Figure** 2 represents the data collected on the tensile strength of samples annealed at temperatures which caused the maximum effect of cold reduction on the recovery of grain structure. The annealing

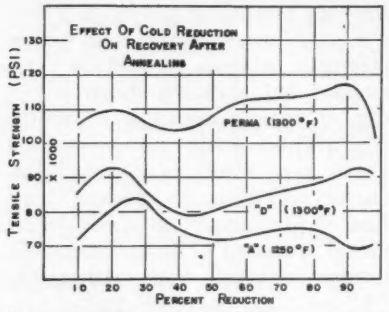


Fig. 2—The effect of cold reduction on recovery after annealing.

temperatures used were 1250°F for "A" nickel and 1300°F for "D" and "Perma" nickel. For each of the alloys a range of reductions between 20 and 30% showed less effect of annealing than was noted on samples reduced between 40 and 50%. Above 50% reduction "A" nickel annealed to a more or less constant tensile strength. In the case of "D" nickel the annealed tensile strength at reductions above 50% increased until 90% reduction was reached. The tensile strength of "Perma" nickel increased above 40% and remained nearly constant between 60 and 85% reduction. Above 85% reduction instability in recovery was indicated by a rise in tensile at 90% and a sharp decline between 90 and 98% reduction. This decline was thought to reflect the grain boundary destruction noted in samples in the hard drawn condition. In order to fully appreciate the significance of reduction and its influence on annealing, it is necessary to keep in mind the corresponding values of tensile strength of the materials in the hard drawn state at each of the reduction percentages considered.

**Further** indication of the effect of cold reduction after annealing is shown in Figure 3 where the values of yield strength obtained for the annealed wire are plotted. It will be noted that the maximums of yield strength for the three alloys when reduced between 20 and 30% are very pronounced and that the rates of increase in yield strength above 50% reduction are more or less uniform.

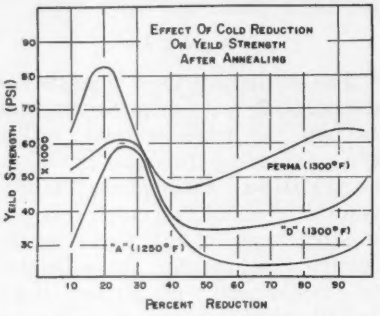


Fig. 3—The effect of cold reduction on yield strength after annealing.

These properties are of particular interest to those wishing to produce wires having closely controlled physical properties since the more uniform are the properties with respect to reduction the wider are the allowable variations in processing which may be tolerated from a practical production standpoint.

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**The** evaluation of elongation data revealed a minimum elongation for all three alloys between 20 and 30% reduction followed by an increase in elongation after annealing as the precentage of reduction increased. For "A" nickel samples the elongation reached a maximum of 36% at 70% reduction and then declined rapidly to a value of 26% at 98% reduction. The elongation of samples of "D" nickel reached a maximum of 36% elongation at 80% reduction and remained nearly constant for reductions above this point with a slight decline occurring above 95% reduction. A maximum elongation of 29% was obtained on "Perma" nickel at a reduction of 85% with a decline to 22% elongation at 98% reduction. From this data optimun elongations were obtained on the materials studied when total reductions were held in the range of 70 to 85%.

**The** grain structures of "A", "D" and "Perma" nickel at the various stages of reduction, both before and after annealing, were studied. Figure 4 shows the typical change in grain structure with cold work for samples of "A" nickel wire at 50, 75 and 90% reduction.

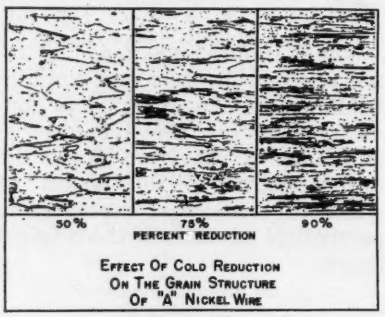


Fig. 4—The effect of cold reduction on the grain structure of "A" Nickel wire.

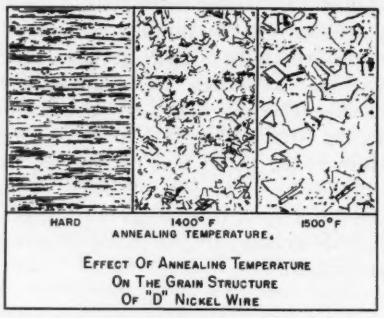


Fig. 5—The effect of annealing temperature on the grain structure of "D" Nickel wire.

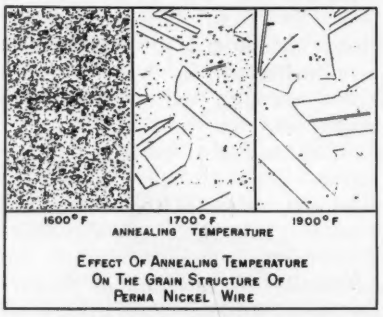


Fig. 6—The effect of annealing temperature on the grain structure of "Perma" Nickel wire.

It will be noted that elongation of individual grains progress until the individual grains are barely detectable at 75% reduction. At 90% reduction continued elongation produces a striated structure in which individual grains are unrecognizable. When annealing occurs the hard drawn striated grain structure recovers so that the grains reassume their initial character-

(*Please turn to page* 1417)

# Reel Drive Selection

by R. K. Larson
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Part II

The first part of this paper, which was delivered at the Annual Convention of the Wire Association in Chicago, Ill., November 14-17, 1955, appeared in the October issue of Wire and Wire Products.

## Torque-Controlled Reel Drives

**The** characteristics and performance of torque control drives are largely determined by the fact that the wire tension cannot be measured directly; the drive can only measure and control the torque applied to the reel shaft. When friction, windage, traverse, and inertia torques are small compared to the tension torque, this will permit accurate tension control. When they are large compared to the tension torque, non-dancer control will become quite inaccurate or ineffective.

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**Several** general types of drives can be placed in the torque control system category:

1. Constant current
2. Torque motor
3. Eddy current coupling
4. Friction clutch
5. Hydraulic motors

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**The** constant-current drive is by far the most flexible of this group. This drive always uses a direct-current motor, supplied from either an adjustable-voltage, direct-current generator or an adjustable-voltage rectifier, with suitable control to maintain approximately constant motor armature current over the reel build-up range. If constant armature current is maintained by adjusting the motor field voltage, the motor torque will increase in proportion to the decrease in motor speed. If the current is controlled by adjusting the motor armature voltage, the motor torque will remain constant. The desired motor torque is selected by providing a reference voltage, and the control compares the motor armature current to this reference. The reference voltage will be adjusted to obtain the desired motor torque.

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**Torque** motors, using either wound-rotor, squirrel-cage, or direct-current motors should be considered as an extension of the constant-current drive for low horsepower applications, where the higher cost of a more flexible drive cannot be justified. The torque motor will usually require more adjustment by the operator during starting and stopping and to follow linear speed changes, but in other respects it will provide equal or better performance than the constant-current drive within its capacity range.

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**An** eddy coupling clutch reel drive is functionally the equivalent of a torque motor in almost all respects. The choice between these two drives for a non-dancer system will depend on a comparison of relative costs and mechanical features. On those dancer applications where wound-rotor motors or eddy current couplings may be used, the smaller control power requirements of the latter may be advantageous.

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**Friction** clutches or slipping belts, when used in a non-dancer control system, can only develop constant torque, and consequently the wire tension will always decrease as the reel diameter increases. Because of the problems of heat dissipation and mechanical wear, they are limited in capacity, tension control may be erratic and torque adjustment is usually rather inconvenient. Because of these limitations, they are now used primarily on low-speed applications, where accurate tension control and frequent tension adjustment are not required.

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**It** is possible to design hydraulic drives similar in almost every respect to an adjustable-voltage, direct-current motor drive. Such a drive could be used to provide the equivalent of an electric, constant-current drive. However, all hydraulic systems that are in common use provide only the equivalent of armature voltage control of a direct-current motor. As a result, in a non-dancer control system, they provide constant torque rather than constant tension reeling. Hydraulic systems must operate at high pressure to obtain cost and performance equivalent to electric drives. The greater ease of installing electric wiring rather than hydraulic piping, and the difficulty in preventing leaks in hydraulic systems, have tended to limit the use of hydraulic reel drives in the wire industry. However, their low inertia and the short length of piping required makes them very suitable for reel traverse drives.

## CONSTANT-CURRENT DRIVES

**On** most motor applications, it is only necessary to insure that the motor is large enough to provide adequate torque capacity for the machine load over the desired speed range. Occasionally, the maximum motor torque capacity must be limited to protect the machine, but this protection will sel-

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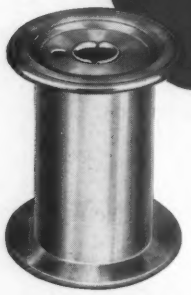

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| 3" | 3" 3¼" 3½" | 1¾" or 2" | .625"-.633" |
| 4¼" | 3" 3¼" 3½" | 3¼" | .635" |
| 4½" | 3" 3¼" 3½" | 2½" | .635" |
| 4½" | 6" | 2½" | .635" |
| 5" | 2¾" 3" | 3.880" | .531" |
| 6" | 3" 3¼" 3½" | 3½" | .635" |
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| 7" | 3" 3¼" 3½" | 3½" | .750" |
| 7" | 6" | 3½" | .750" |
| 8" | 3½" 6" 6¼" | 4" | 3" or 3¹³⁄₁₆" |
| 8¼" | 3½" to 7½" | 4" | 3.630" |
| 10" | 6" | 5" | Optional |
| 12" | 6" | 6" | Optional |

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TABLE 4

CONSTANT-CURRENT DRIVE APPLICATION GUIDE

Consider constant current when -

1. Indicated reeling power (maximum tension in pounds times maximum linear speed, fpm) is not less than 100,000 ft-lb/min and generally over 200,000 ft-lb/min.
2. Main machine uses adjustable-voltage, direct-current drive.
3. For multi-purpose machine where linear speed and required tension change frequently.
4. When additional cost is justified to obtain automatic following of change in linear speed by reel drive and to make setting of tension-adjusting rheostat independent of linear speed.
5. When a small radio-type, tension-adjusting rheostat is desired.
6. When minimum tension is not low enough to require dancer.

TYPICAL APPLICATIONS

1. Wire flattening mills.
2. Tandem, rod breakdown machines, either ferrous or non-ferrous.
3. Shaving benches.

dom be less than 150% of the maximum load torque. However, on a constant-current reel drive, more trouble may be encountered if the motor is too large than if it is too small, since operation is most critical when using only a small part of the motor capacity.

## Effects of Friction

**Figure** 6 illustrates a typical set of conditions for a constant-current reel drive. The friction loss will usually be proportional to the rated **maximum** torque of the motor. In this example, windage losses have been neglected, which is a reasonable approximation for wire speeds of less than 3000 fpm. The motor has been selected with a 3:1 speed range by motor field control to correspond to the reel build-up ratio, although normally the motor speed range would be 10% to 20% more than the build-up ratio to insure control at the extreme reel diameters. Under these conditions, the friction loss will be 15% of the **actual** motor torque with an empty reel. If a 10:1 tension range is required, it is obvious that the friction torque with an empty reel will be the largest part of the load. If the friction losses vary by 50%, they will cause an even wider tension variation unless the tension control setting is changed. If an oversize motor is used, and the same minimum tension is required, it is equivalent to using a wider tension range, and the friction losses will be even higher relative to the minimum tension torque. This example is quite conservative in that it has been assumed the motor capacity is only sufficient to provide the exact torque required for maximum tension and the friction torque was only 5% of the maximum motor torque. Actually, on some applications, such as on wire flattening mills, the friction losses may be as large as 10% of the **maximum** motor rated torque, and it is seldom that the motor rating will exactly match the required maximum tension torque. From the example, it will be seen that even with a tension range of 5:1, the tension would tend to increase when operating near the lower end of the tension range. Windage losses increase this effect.

## Characteristics of Constant-Current Regulators

**It** may also be seen from Fig. 6 that the action of the regulator in a constant current control system produces an effect similar to friction and windage. The class of regulators normally used in the wire industry will require an increase of approximately 5% rated full load armature current to change the motor speed from empty reel speed to full reel speed. The current change is essentially constant regardless of the total armature current required. Thus, if the drive is holding 10% armature current, this would result in a 50% change in the actual armature current. In Fig. 6, if there were no friction losses, an armature current of 10% rated value would be selected with an empty reel. However, to allow for the losses, it is necessary to select 25% rated armature current. The current then increases to 30% of the rated value with a full reel. Since the friction losses now only require 5% of the rated motor current, the motor torque applied as wire tension has increased from 10% to

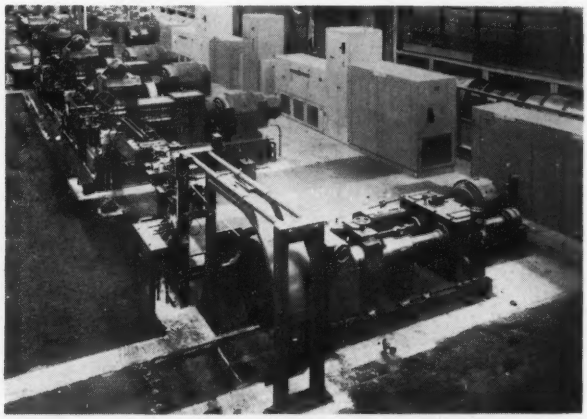

Photo C. Constant-current reel drive used on tandem wire-flattening mill.

25%, and the full reel tension is two and one-half times the selected tension.

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**This** increase in tension may be offset to some extent since almost all constant-current reel drives provide "tension taper" either deliberately or unavoidably. It has been assumed that the motor field strength would vary in proportion to reel diameter, so that the motor torque, at constant armature current, would vary directly with the reel diameter. Actually, most constant-current reel drives reduce the armature voltage slightly as the motor field strength is increased. The armature voltage control is required to provide stalled tension and insure control at very low speeds during starting and stopping. With this arrangement, the motor torque will not increase in exact proportion to the decrease in motor speed. By selecting the proper ratio of armature voltage change to motor field voltage change, the errors due to friction and control can be compensated. However, the effect of this "tension taper" changes for different tensions and linear wire speeds. If it is adjusted to give essentially constant tension at maximum speed, the drive may have almost constant torque characteristics at 10% of the maximum speed. Fortunately, this is usually quite acceptable, since approximately constant tension may be very desirable with small wire at high speeds, but constant torque will provide perfectly acceptable operation with large wire at low speeds.

## Acceleration and Deceleration

**The** most extreme tension variations with non-dancer control will usually occur during acceleration and deceleration. Figure 7 shows the torque required at the reel to maintain a tension of 20 pounds plus the torque required to accelerate an empty reel. It will be seen that a tension of 20 pounds is approximately 10% of the torque required to accelerate the empty reel. The problem is to supply sufficient torque to the reel shaft to prevent slack wire, and yet not overstress the wire during acceleration and deceleration.

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**The** torque required by the reel drive for inertia is a direct function of the acceleration and deceleration rates of the main machine, as may be seen by the formula for accelerating torque.

$$T = \text{Tension Torque} + \frac{(\text{Machine } WK^2 + \text{Motor } WK^2)\ (\text{Final RPM} - \text{Initial RPM})}{308t}$$

Torque = Total developed motor torque, pounds-feet
$WK^2$ = Inertia in pounds-feet$^2$
t = time for speed change in seconds
308 = constant

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**Thus,** the required reel drive accelerating torque will vary widely if stepped acceleration is used on the main machine, as will be the case with a wound-rotor or constant-potential, direct-current motor drive. Since the changes in the main drive accelerating rate are practically instantaneous, it is impossible for the reel drive regulator to follow them. Because of the acceleration and deceleration problem, full advantage of the flexibility and range of the constant-current drive can seldom be obtained unless an adjustable voltage drive is used for the main machine.

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**If** the wire tension required during running is large relative to the maximum accelerating torque, as would be the case with a tension of 100 pounds in the example of Fig. 7, sufficient torque could be applied to the reel drive so that it would accelerate more rapidly than the main drive except on peaks of such short time intervals that they could be neglected. At the end of each main drive accelerating step, the excess reel torque would appear as tension, and at the peak of each step, the tension would be essentially zero. If the normal running tension is well below the maximum allowable tension, the excess tension would do no harm. Momentary loss of tension is almost never a problem during the brief accelerating period, providing it does not allow any slack wire to develop. Take-

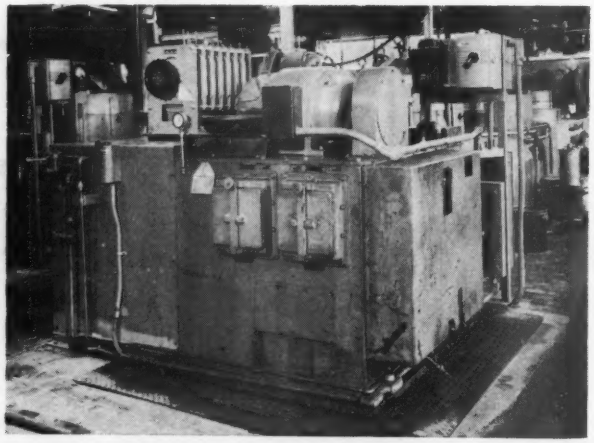

Photo D. Wound-rotor torque motor reel drive on shaving bench. * *

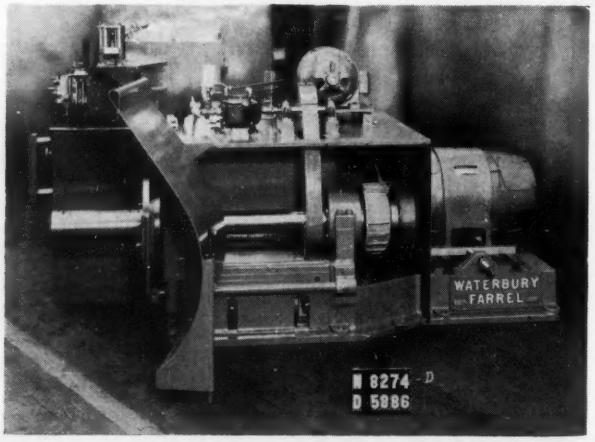


Photo E. Wound-rotor torque motor reel drive on intermediate wire-drawing machine. * * * * * * * * * * *

up reel drives for bull blocks, shaving benches, low-speed wire-flattening mills, or cabling machines can frequently use very simple torque control drives, because the accelerating torque is very low relative to the maximum tension the wire or cable can withstand.

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**The** deceleration problem is very similar to the acceleration problem when the main drive uses dynamic braking or coasts to a stop under load. In both cases, the decelerating rate will vary widely and as a function of load. Many times, deceleration is an even more serious problem than acceleration, because the full reel inertia is so much greater than the empty reel inertia. Brakes can seldom be of much assistance, unless the wire is almost strong enough to stop the reel by itself, or the wire can slip at the main machine.

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**On** wet-type wire drawing machines, the wire normally slips at all times on the "wet" capstans. The final block (or capstan) normally runs dry, and sufficient wraps are taken around this block so that with normal running tension, the wire does not slip. The speed of the block then determines the linear wire speed. However, if the wire is not pulled tight on the finishing block before starting, it is quite possible to allow the wire to slip during acceleration. If the main drive is started a fraction of a second before the spooler (and always accelerates more rapidly than the spooler), the spooler will establish the linear wire speed during acceleration. The wire cannot pull tight until the spooler attempts to pull the wire faster than the surface speed of the capstan, and this condition cannot occur until the main drive has reached full speed. After the wire is tight, the linear speed will be maintained by the speed of the final block, and the spooler will establish the wire tension. To stop, braking torque is first applied to the spooler. As the surface speed of the spooler decreases, the wire will begin to slip, and the reel will again establish the linear wire speed. The main drive may then be allowed to decelerate. Sufficient torque must be applied to the spooler so that it will decelerate slightly faster than the main machine.

## Effect of Adjustable-Voltage Main Machine Drive

**The** use of an adjustable-voltage main drive does not in itself insure that adequate acceleration and deceleration control will be obtained. If the motor field strength is preset before starting, the accelerating rate will vary in porportion to the maximum linear speed that will be obtained. If time delay generator field contactors are used. there may be a substantial change in the momentary accelerating rate. Therefore, the proper control circuit must be used in conjunction with the adjustable-voltage drive.

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**Another** source of tension error during acceleration and deceleration is introduced when the motor field strength varies from the proper value corresponding to the reel diameter. On most constant-current reel drives, the full field torque, corresponding to full reel diameter, will be developed by the reel motor during a portion of the accelerating cycle. The maximum tension error introduced by this condition is a function of the build-up ratio and the motor field range.

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**The** problem of initiating acceleration and deceleration of the main machine and the reel drive at the same instant may also be serious when the inertia forces exceed the maximum allowable tension. It is obvious that tensions beyond the deformation strength of the wire cannot be applied for even a fraction of a second without causing a weak point in the product. It is a practical impossibility to insure that exactly the correct degree of inertia compensation is present at the beginning and end of all transient speed conditions. This imposes an additional limit on the accuracy of the tension control that can be obtained with a torque control system.

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**Even** an adjustable-voltage drive with the proper control circuit does not provide a complete answer when it is necessary to accelerate reels containing varying amounts of wire. If the main machine is supplied from coils so that the incoming wire can be continuously welded, this may not be a serious problem, since the machine will only be stopped after a reel has been filled, or if the wire breaks. But when the wire is supplied from reels, the drive must be stopped before welding. Normally, the required accelerating torque will increase with the amount of wire on the reel, although this will depend on the ratio of reel inertia to motor inertia. There are a number of partial solutions, but they have definite limits. A rider roll may be

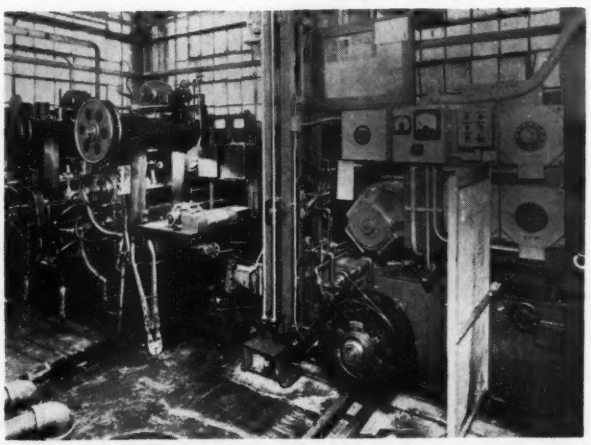

**Photo F. Combination dancer and constant-current reel drive on wire-flattening mill take-up stand.**

TABLE 5

DANCER-ROLL AND CONSTANT-CURRENT DRIVE APPLICATION GUIDE

**Consider a combination dancer-roll and constant-current drive when:**

1. **Tension range of 10:1 or more is required.**
2. **When most wire sizes will not require dancer control, but occasional production of very small wire is required.**
3. **Most accurate tension control during acceleration, deceleration, and running is desired.**
4. **Minimum dancer roll storage is required.**

TYPICAL APPLICATIONS

1. **Wire flattening mills.**
2. **All types of heavy and intermediate wire drawing machines.**

used to measure diameter and increase the inertia compensation accordingly, but this is easily damaged and interferes with reel handling. An adjustment for inertia compensation may be placed on the operator's control cabinet, but it is difficult for most operators to make the proper setting. The simplest and most practical means of reducing this problem is to decrease the accelerating and decelerating rates since the accelerating and decelerating torques required will decrease in direct proportion. However, accelerating and decelerating times of more than about 30 seconds are generally unacceptable to wire manufacturers. Even though accelerating and decelerating periods of 60 seconds or longer would normally have a negligible effect on the average production speed of most wire processing machines, they make a poor impression on observers.

TABLE 6

WOUND-ROTOR TORQUE MOTOR APPLICATION GUIDE

**Consider wound-rotor torque motor when:-**

1. Squirrel-cage torque motor does not have adequate capacity.
2. Simplest, minimum cost drive is desired.
3. Single-purpose or limited-range machines are involved.
4. When wire can slip in main machine, or tension increase of 2 to 5 times running tension, will not damage product during acceleration and deceleration.
5. When indicated reeling power (maximum tension in pounds times maximum speed in fpm) is in range of 3000 to 200,000 ft-lb/min.
6. Change gears or multiple pulley are acceptable for covering linear speed range over 2:1.

TYPICAL APPLICATIONS

1. Slip-type, heavy and intermediate wire-drawing machines.
2. Tinning lines
3. Low-speed (under 500 fpm) wire-flattening mills that do not use adjustable-voltage main drives.
4. Accumulation-type, steel wire-drawing machines.
5. Shaving benches.
6. Cable reels.
7. Wire straighteners

## COMBINATION DANCER-ROLL AND CONSTANT-CURRENT DRIVE

On many wire industry reel drives, it is necessary to use dancer control for only a small part of the range of wire sizes that will be produced. If the drive is suitable only for dancer operation, dancer control must be used at all times, even though it may not be required for many wire sizes. By selecting a drive that can operate as either a dancer or non-dancer system, advantage may be taken of the simpler threading operation, reduced wire bending, and decreased dancer roll maintenance obtained by operating without dancer roll control. This freedom in selecting the mode of operation may be even more desirable when it is considered that many wire manufacturers frequently specify a machine to finish several small wire sizes only to supplement other production facilities. As a result, the sizes that dictate the choice of the dancer control system might constitute a small or even negligible portion of the total machine production.

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**Unfortunately,** most torque control drives do not make good dancer control drives, and the reverse is also true. However, the General Electric Company has recently developed a combination drive that not only requires less wire storage on dancer operation than other types of dancer roll drives, but also provides far superior tension control on constant-current operation than other non-dancer drives, and costs only slightly more than

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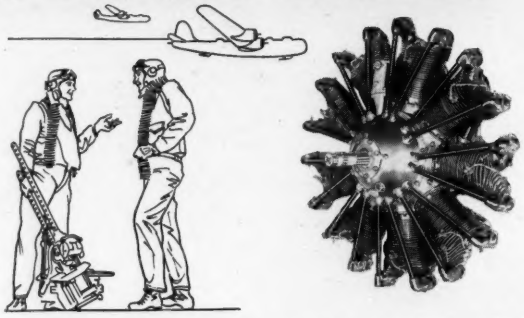

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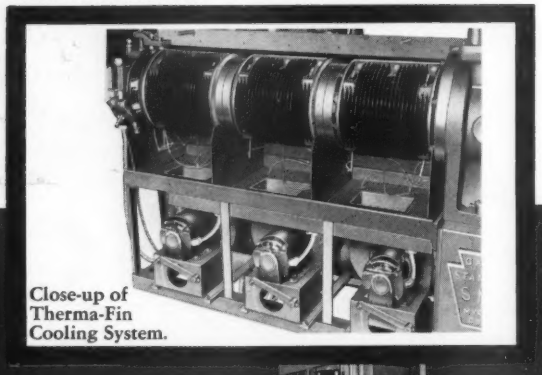

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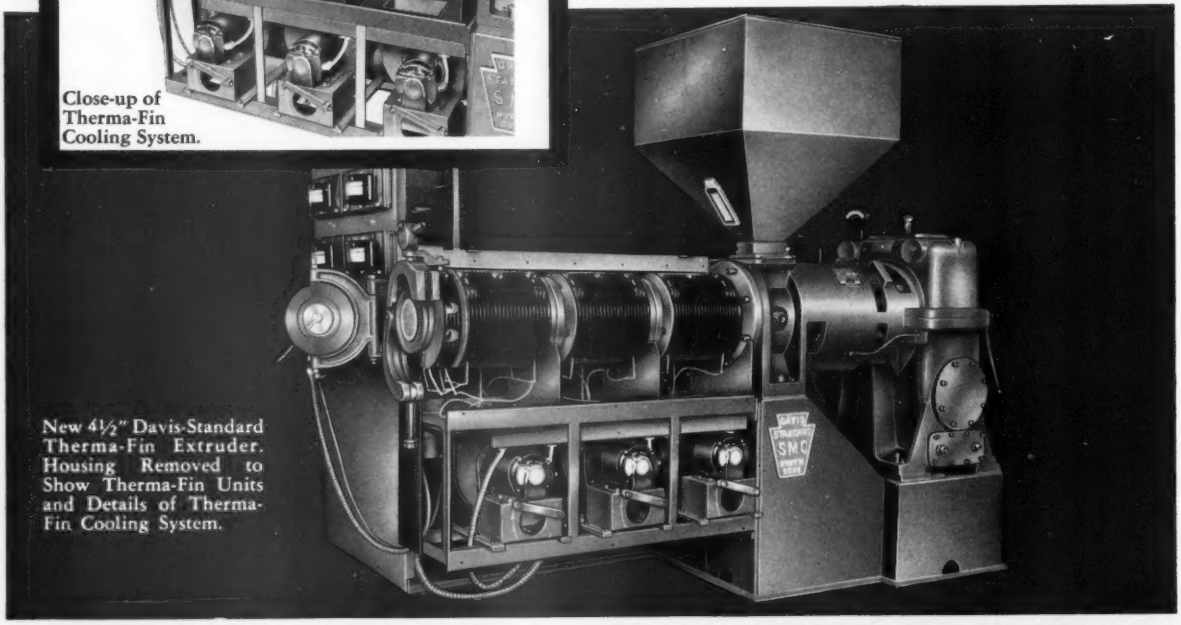

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a conventional constant-current drive. While the drive may be used for only dancer control or for only constant-current control, the cost will be essentially the same when it is supplied to operate as a dual system. The many advantages of this drive are given below:

**Essentially Unlimited Tension Range— Since dancer control may be used when light tension is required, the reel motor may be as large as required without having an adverse effect on the tension control of small wire. With non-dancer operation for large wire, there is no limit on the dimensions or shape of the maximum size wire that can be accommodated.**

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**Essentially Unlimited Linear Speed Range — This drive automatically compensates for the "tension taper" effect on most constant-current drives, so that essentially the same tension control characteristics will be obtained at any linear wire speed. When using the dancer control system, linear speed has no effect on tension in any case.**

★ ★ ★

**Accurate, Non-dancer System Tension Control — The regulator error, mentioned previously for constant-current controlled drives is not present with this drive. Thus, essentially constant tension is always maintained over the reel build-up ratio. When friction and windage losses prevent accurate tension control, the dancer roll may be used.**

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**Flexible Non-dancer Tension Control — If constant tension is not desired, a simple modification will allow a wide range of "tension taper" to be obtained.**

★ ★ ★

**Can Easily Accommodate 500-lb., 1000-lb., or 2000-lb. Reels — Since the drive automatically compensates for change in reel dimensions, more accurate tension control can be obtained over a wide range of reel diameters.**

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**More Accurate Tension Control During Transient Speed Conditions — With this drive, inertia compensation can be provided not only in proportion to the main drive accelerating and decelerating rates, but also in proportion to the quantity of wire on the reel. The motor torque developed during acceleration and deceleration will always remain proportional to the reel diameter. Because of these features, the wire tension can be maintained during acceleration and deceleration much more accurately than with any other non-dancer system.**

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**Minimum Dancer Roll Storage — Due to the automatic compensation for reel diameter provided by this drive, the dancer roll is not required to control the motor speed over as wide a range as with other dancer roll drives. The effect of this is the same as increasing the storage in the dancer roll loop. As a result, stable operation can be obtained with less actual storage in the dancer roll loop.**

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**Centered Dancer Roll Position — With other dancer roll drives the dancer roll position must change with reel diameter. This movement may use part, or all, of the dancer roll storage depending on the drive arrangement. With this drive, the dancer roll stays in the center position of the storage loop from empty to full reel, with only momentary movements to correct the reel motor speed. Because of this, constant tension will be maintained even when using dancer rolls with non-parallel sides. It also may be very helpful in reducing the required wire storage when a dancer roll drive must follow a main machine using stepped acceleration. With a conventional dancer control drive, storage to accommodate the accelerating peaks of the main drive must be added to the storage required for stable running operation. With this drive, half of the wire storage required for running is also available for this acceleration function.**

TABLE 7

SERIES-WOUND DIRECT CURRENT MOTOR APPLICATION GUIDE

Consider series-wound direct-current motors when:-

1. Linear speed is low (generally 300 fpm or less).
2. Indicated reeling power (maximum tension in pounds times maximum linear speed in fpm) is in the range 1500 to 60,000 ft-lb/min.
3. Ratio of empty to full reel diameter is over 3:1 but not more than 6:1.
4. Moderate tension range of less than 10:1 is required.

TYPICAL APPLICATIONS

1. Same fields as squirrel-cage and wound-rotor torque motors, Tables 6 and 8.
2. Most often used in textile, rubber and plastic industries, that require high ratios of full to empty reel diameters.

TABLE 8

SQUIRREL-CAGE TORQUE MOTOR APPLICATION GUIDE

Consider squirrel-cage torque motors when:-

1. Linear speed is very low (generally 100 fpm or less).
2. Indicated reeling power (maximum tension in pounds times maximum linear speed in fpm) is 3000, ft-lb/min or less.
3. Ratio of empty to full reel diameter is 3:1 or less.
4. Moderate tension range of less than 10:1 is required.

TYPICAL APPLICATIONS

1. Enameling line take-ups.
2. Small wire tinning line take-ups.

Since this is the only drive that can meet all the demands of the most difficult wire industry reeling requirements, it should always be considered for high-speed, wide-range machines.

## TORQUE-MOTOR DRIVES

**Torque** motors are an economical means of obtaining the excellent tension control, reliability, compactness, and ease of adjustment of electric spooler drives when the cost of a dancer roll or current-control drive cannot be justified. While torque motor reel drives could be used up to several hundred horsepower, they are seldom economical for a "tension horsepower"

(maximum linear wire speed times maximum wire tension) of more than 15 horsepower. In large ratings, the control cost and power loss in the resistors will generally make the constant-current drive lower in both initial and operating cost.

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**These** drives can provide the same quality of tension control as the constant-current system. They are also subject to essentially the same limitations on acceleration, deceleration, and tension range. However, unlike the constant-current drive, they do not automatically maintain the same tension at different linear wire speeds. The tension control setting must be changed to obtain the same tension when the linear speed is changed.

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**If** the minimum size motor and a close approach to constant tension over the build-up range is required for a linear speed range of more than 2:1, it will usually be advisable to change the gear or pulley ratio in proportion to the linear speed. It will almost never be necessary to use more than three ratios for any linear speed range up to 10:1, and more often than not, two ratios will be adequate.

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**If** the application does not require the full capacity of a torque motor, and approximate constant torque winding is acceptable, a gear or pulley change would not be required.

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**It** is preferable to belt-connect the motor to the reel shaft. If the friction and windage losses have not been estimated correctly, a different degree of tension taper is desired, or if the product size or linear speed should be changed, the ratio can be modified to meet the new conditions quickly and with little expense.

## COMPARISON OF TORQUE-MOTOR AND CONSTANT-CURRENT DRIVES

**When** a non-dancer system is to be used, and the application is within the capacity range of a torque-motor drive, the performance of the constant-current drive should be compared with the torque-motor drive on the following points:

**Tension Control — The tension range and quality of tension control over the reel build-up range are substantially equal.**

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**Cost — The cost of the torque-motor drive will range from 25% to 75% of the equivalent constant-current drive when the horsepower rating of the constant-current drive is 15 hp or below. Above this rating, the costs will usually be about equal, and the constant-current drive may be less expensive.**

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**Linear Speed Range — The constant-current drive will automatically follow changes in linear wire speed, and will maintain approximately the same tension if the adjustment of the tension control device is not changed. A torque motor may require a change in gear or pulley ratio for different linear wire speeds, and the setting of the tension control rheostat must always be changed to maintain the same wire tension.**

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**Acceleration and Deceleration, Adjustable-Voltage Drive for Main Machine — More accurate control of tension can be obtained with the constant-current drive. However, with a minimum cost constant-current drive, the tension control will seldom be more accurate than when using a torque motor.**

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**Acceleration and Deceleration, Wound-Rotor or Constant-Potential Direct-Current Motor Main Drive — Since the wire must slip during acceleration and deceleration, or be strong enough to withstand wide variations in tension, the torque applied to the reel shaft is seldom critical. With either drive, mechanical braking will be required during stopping, since dynamic braking of a torque motor or a direct-current motor cannot provide sufficient torque. In some cases, the constant-current drive may have a slight advantage because the breakaway torque may be applied gradually, but in most cases the torque motor has the more important advantage that the maximum torque is inherently limited.**

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**Reel Build-up Ratio — When the build-up ratio of a single reel or the ratio of the maximum flange diameter to the minimum barrel diameter of several reels is more than two-and-one-half to one, the current regulated drive will usually provide a closer approach to constant tension. It may be necessary to use a gear or pulley ratio change for different reels with a torque motor, while the constant-current drive will accommodate a total ratio of up to six to one, although much better operation is possible if the maximum ratio does not exceed four to one.**

## DRIVE EVALUATION

**Every** effort has been made to avoid describing the various reel drive systems in technical electrical terms. Actually, there is seldom any need for a detailed analysis of circuits and components to select the proper system. The circuits and components are primarily of interest from the maintenance standpoint. However, there are a few fundamental principles of drive design that should be understood when comparing various drives.

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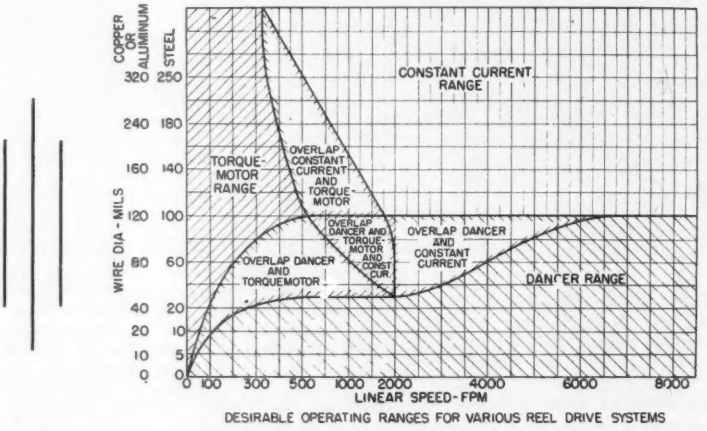
**All** regulated systems of the constant-current type require the use of an amplifier. The dancer roll system may require an amplifier depending on the ratio of wire storage to maximum linear wire speed. Amplifiers may use electronic tubes, rotating equipment of the amplidyne type, or magnetic amplifiers such as the amplistat. Since the amplifier is merely one component of the drive, the use of




DESIRABLE OPERATING RANGES FOR VARIOUS REEL DRIVE SYSTEMS

FIG 9

a particular amplifier **does not in itself** provide a superior drive for any given installation. It is very seldom that equal performance cannot be obtained on a specific application using any of these amplifiers with a properly selected circuit. Except when the machinery builder or the wire manufacturer prefers a specific amplifier because of reliability or maintenance familiarity, the amplifier should be chosen by the drive application engineer to provide the required performance at the lowest cost.

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**The** accuracy or error of a constant-current control circuit is of little interest by itself. Since the wire tension is measured indirectly, the system accuracy will always be limited by the friction, windage, traverse, and inertia torque requirements. High-accuracy current-regulating control circuits and dancer roll circuits with low ratios of dancer roll storage to maximum linear speed increase the difficulty of obtaining stable operation. With increased accuracy requirements, the cost of the drive will be higher because of additional components, special design, and extra engineering. The installation time required to obtain stable operation may also be increased.

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**There** will almost always be more than one drive that will meet the functional requirements of a particular installation. Figure 9 and Table 9 will frequently be helpful in selecting the best system, and the selection of a specific drive will generally be based on the relative importance of the following factors:

1. **Purchase price**
2. **Flexibility of operation**
3. **Dependability of operation**
4. **Simplicity of operation**
5. **Installation time and expense**

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**Purchase** price can easily be determined and will always be a major factor in the selection of a drive. It is more difficult to evaluate the remaining factors, but because of their effect on production efficiency, they should always be carefully considered.

TABLE 9

COMPARISON OF DRIVE CHARACTERISTICS

| | Factor | Torque Motor | Constant Current | Dancer* | Combination Dancer-Constant-Current |
|---|---|---|---|---|---|
| 1) | Tension Range | Moderate, usually 5:1 | Moderate, seldom more than 5:1 | Wide 10:1 to 20:1 | Essentially unlimited |
| 2) | Linear Speed Range | Less than 2:1 if change gears are not used | Wide | Wide | Wide |
| 3) | Capacity | Limited, seldom over 15 hp | Unlimited | Physical limitation on bending wire | Unlimited |
| 4) | Cost | Minimum | Moderate | Varies from low with ample storage to high with minimum storage | Between constant current and dancer with minimum storage |
| 5) | Complexity | Very simple | Fairly complex | Complex for min storage, simple with ample storage | Slightly more complex than constant current |
| 6) | Hold very light tension at high speed | No | No | Yes | Yes |
| 7) | Tension variation empty to full reel | Low to moderate | Low to moderate | None | None to low |
| 8) | Tension variation during acceleration and deceleration | Very wide unless wire slips in main machine | Varies from excellent control to same as torque motor | None to slight | None to moderate |
| 9) | Maximum ratio full to empty reel | Moderate less than 4:1 | Fairly wide, may be up to 6:1 but best results 4:1 or less | Unlimited | Limited by constant current operation |
| 10) | Change gears required | Yes, for wide linear speed range or wide range of reel sizes | Generally no May be required for wide range of reel sizes | Only for very wide range of reel sizes | Only for very wide range of reel sizes |
| 11) | Floor space at machine | From same as constant current to slightly more | Minimum | Moderate | Moderate |
| 12) | Change required in tension setting for same tension at different linear speeds | Yes | Yes for tension near minimum | No | No |

* The mechanical design of the dancer will determine the minimum tension and the largest wire that can be used

**Flexibility,** dependability, and simplicity of operation are considered to the degree that they exceed the minimum functional requirements of the application. Additional flexibility might allow using a particular machine to supplement the production of other machines in the event of breakdowns or to meet production peaks. In some cases, it might permit using one machine to cover a range of product sizes that would normally require two machines.

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**Dependability** should measure not only maintenance time and frequency, but also freedom from wire breakage and variation in operating characteristics. Greater simplicity of operation may reduce threading time and make production more independent of the operator's skill.

★ ★ ★

**Since** installed cost is the true cost of a drive, the installation time and expense should be added to the purchase cost when comparing drives. This factor can only be estimated, but it can be a substantial figure on difficult applications. The higher cost of a more flexible drive may be more than justified by a reduction in the time required to place the machine in production. This may be an important factor with marginal, non-dancer control system applications.

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**Selection** of reel drives for wire industry applications will never be a simple problem. No other industry encounters the combination of high linear speeds, small product size, and high inertia reels as frequently as the wire industry. Steel and non-ferrous strip rolling mills may use equivalent speeds while the textile and paper industries may encounter similar limitation on material strength, but the wire industry continually faces a combination of these conditions. It follows, in the light of the unusually exacting requirements of wire reeling drives, that the best drive for a particular installation can only be selected by careful and complete consideration of the many factors influencing the performance and the cost.

# The Trend Toward Vinyl Insulation In Automotive Wiring Systems

by R. H. Publow, Chief Chemist
Essex Wire Corporation
Detroit, Michigan

This paper was presented at the Annual Convention of The Wire Association in Chicago, November 15, 1955.
The author graduated from Michigan State College in 1940, where he majored in organic chemistry. He followed this with graduate work at the University of Akron. After a period of service in the engineering laboratories of the Chrysler Corporation, he joined Essex, where for the last thirteen years he has served in various technical capacities concerning wire and insulation design and engineering. In his capacity as Chief Chemist he has had much opportunity to observe the growth in the trend toward vinyl insulations in automotive primary circuits.

**The** early motor car equipped with the six volt battery and electric headlamps marked the practical beginning of our present complex automotive wiring systems. Since those early days, automotive wiring engineers have clung doggedly to a single wire construction with but few variations until the last four years. This basic construction incorporated a rubber insulation extruded over a long lay bunched copper conductor. The rubber insulation was then covered with a fairly close cotton braid which in turn was coated with a cellulosic type lacquer. To go back for a moment and be more specific on details, the rubber insulation used was rather low grade and low cost, being only 17% to 19% rubber hydrocarbon and much of this coming from reclaim. It had a tensile strength of 500-600 P.S.I. and elongation of 250-300%. Aging characteristics were in general modest and electrical properties were considered unimportant and were uncontrolled. Wall thickness of extruded rubber stood at .023 inches for years. About the only real basic change in this insulation over the years was a general switch from natural rubber to butadiene-styrene rubber (GR-S) following World War II. The braid details also withstood the test of time. Most automotive primary wire was made with 14/1 cotton yarn though other sizes and plys enjoyed spotty popularity for short periods. Most automotive manufacturers accepted standard two over two under braid patterns while others sought additional abrasion resistance in one over one under basket weave patterns. Most heavy duty uses called for 50/50 cotton and paper twine braids.

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**In** spite of this seemingly large number of modifications, braids in general for specific uses remained essentially constant over the years. The final lacquer finish underwent but one important change. At one time nearly all braided automotive primary wire was coated with nitrocellulose base lacquer made from film scrap. As the film industry gradually swung from nitrocellulose to their present triacetate and film scrap disappeared, primary wire coatings went to ethyl cellulose. Even prior to the actual disappearance of film scrap, ethyl cellulose was gaining popularity because of its improved flame resistance, aging stability and sunlight stability. All in all, the changes in primary wire construction can be classified only as slight modifications rather than significant developments. The construction itself was a good one. It was easily adapted to automotive harness manufacture, was economically sound and, above all, field failures in normal automotive service were absolute rarities. There seemed to be little reason to change until the sheer momentum of vinyl insulations and the development of semi-rigid vinyl formulations carried the industry into its first real revolution.

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**The** first attempts to utilize vinyls as automotive primary wire insulations were as a direct substitution for the rubber insulation under the braid. Wall thicknesses were reduced slightly, but the construction was doomed to short life because of economic questionability. It seemed almost impossible to replace the low cost rubber insulation with comparatively high cost vinyl with only a slight reduction in over-all braid weights. Development progressed almost immediately to semi-rigid vinyl with no outer covering whatever. Wall thicknesses remained about the same as the previous rubber wall thicknesses so overall diameters dropped about equal to that built up by the former braids. First proposals in this construction brought a flood of unanswered questions and myriads of new problems. Would the thermoplasticity of vinyl cause failures due to either warm or cold flow? What about abrasion resistance? Could the low temperature flex and high temperature stability be depended upon? What about circuit identification and soldering terminals and all of the other problems of turning the basic insulated wire into finished wiring harnesses?

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**Many** of these problems were answered by careful selection of the formulations for the insulations themselves. The amounts and types of plasticizers used with the basic polyvinyl chloride required careful attention and analysis. The high temperature requirements of normal automotive service are not sufficiently high to limit the plasticizer selection to the high molecular weight resinous types.

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**Service** conditions allow the use of the medium molecular weight

esters showing comparatively good volatility characteristics. Since the insulation must be semi-rigid to maintain good abrasion resistance, total plasticizer contents are limited to around 30 parts per hundred to resin. Such formulations do not, as a rule, exhibit outstanding low temperature properties and consequently a substantial portion of the plasticizer must be one of the good low temperature types. Many compounders feel that this type plasticizer should constitute at least 40% of the total plasticizer content. Inert loadings must be held to a minimum consistent with cost and stabilization and lubrication can be selected without attention to unusually severe requirements. Based on these considerations, a typical insulation would have the following general formulation:

| | |
|---|---|
| Polyvinyl Chloride resin | 100 parts |
| High boiling phthalic anhydride ester | 17 parts |
| High boiling sebacic acid ester | 13 parts |
| Fine precipitated calcium carbonate | 3 parts |
| Basic carbonate of white lead | 3 parts |
| Oil or Wax Lubricant | 0.5 parts |
| Total | 136.5 parts |

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**Formulations** of this type will meet most of the service requirements but lack good extrudability, particularly from dry blends. Satisfactory extrusion can be obtained, however, from conventional equipment provided the screw volume ratio reduction does not exceed 3-1 between the throat and the head. High ratio screws tend to build extrusion temperatures excessively, resulting in varying degrees of decomposition.

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**Turning** for a moment to typical comparisons between the old rubber and braid construction and the new vinyl insulated wire shows a general improvement in the most important finished wire properties. The new construction shows obvious improvement in resistance to discoloration by heat or ultraviolet light, flammability, resistance to attack by fungus and resistance to petroleum lubricating oil. Obvious improvements in electrical properties such as dielectric strength and insulation resistance are also apparent though the importance of such properties is, perhaps, debatable. The big gains, however, are made in the combination of abrasion resistance and low temperature flex.

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**Abrasion** resistance is a difficult subject to discuss, particularly with respect to the thermoplastics. If the method of test is one that tends to build heat as the abrasion progresses, a thermoplastic will show poorer results in comparison with non-thermoplastics such as cotton and rubber. If, on the other hand, the abrasion is slow and allows adequate cooling time, the thermoplastics exhibit their full abrasion qualities. Many automotive wiring engineers hold the view that this latter type of abrasion is the principal type encountered in automotive service while others, though perhaps conceding the truth of the observation, take the position that abrasion tests that tend to build heat show abrasion characteristics more clearly. Without entering into the controversy, standard abrasion tests can be run on both wire constructions using methods that will reveal abrasion characteristics under both types of tests. For this comparison we have selected a slow speed squirrel-cage type abrader shown in Fig. 1 for the no heat build-up tests. This tester operates at about 5 full cycles per minute with a reciprocating motion. Weights, depending on gauge size, are attached to the ends of the wire and a failure is signaled when the abrasion bars of the cage wear through to the conductor closing a relay circuit. A standard S.A.E. abrasion tester can be used to measure abrasion characteristics under conditions producing heat build-up. This type equipment is shown in Fig. 2. The abrasion is accomplished by a sandpaper tape passing beneath the sample which in turn is held against the abrading surface by a weight. The sandpaper is marked each 6 inches with a conductive carbon black dispersion and as a bare conducter crosses one of these marks a relay circuit is closed indicating a failure. The inches of tape passing beneath the sample before failure are read from the indicator and recorded as the abrasion value. The tape speed is approximately 50 inches per minute.

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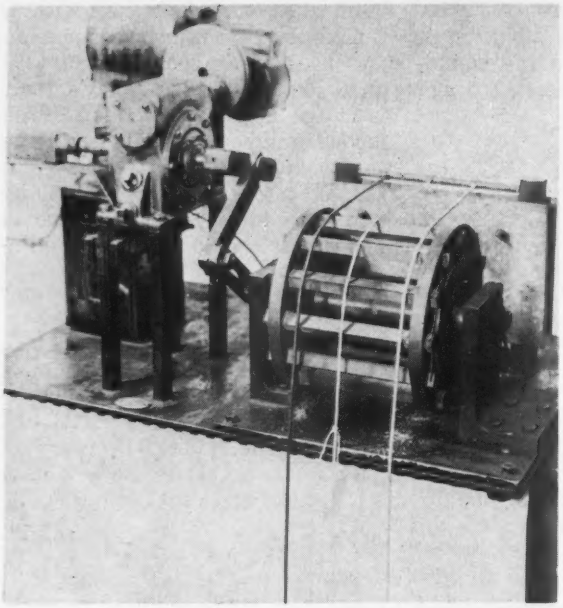
**Using** identical 16 gauge conductors and building primary wire constructions as previously discussed, that is, first; using a .023 wall of low grade rubber covered with a 14/1/2 conventional cotton braid at 21 picks and ethyl cellulose lacquer; second, using a .023 wall of low grade rubber covered with 14/1/2 basket weave cotton braid at 21 picks and ethyl cellulose lacquer; third, on .023 wall of semi-rigid vinyl insulation with no covering whatever. Testing these three constructions on the two abraders described above under identical conditions of test, the following relationships will be found:

| | SAE Sandpaper Abrader | | Squirrel-Cage Abrader | |
|---|---|---|---|---|
| | Inches | Relationship | Cycles | Relationship |
| Rubber & Conventional Cotton Braid | 22 | 100 | 108 | 100 |
| Rubber & Basket Weave Cotton Braid | 28 | 122 | 134 | 124 |
| .023 Wall Vinyl No covering | 36 | 164 | 1062 | 983 |

**Irrespective** of the type of test, the basket weave cotton has about the same relationship to conventional weave—that is, basket weave has about 123% of the conventional abrasion resistance. The effect of the sandpaper heat build-up is clearly shown by its change in relationship under the two test methods though the plastic construction has a clear cut abrasion advantage under either method of test. Proper plasticizer balance will maintain such abrasion resistance in the vinyl insulation even while giving low temperature flexibility of -40°C around a 1 inch diameter mandrel. Rubber stocks in this general classification are normally brittle at such temperatures. It is interesting to note at this point that the sandpaper type of abrasion characteristic can be varied within a given formulation merely through altering the type of resin



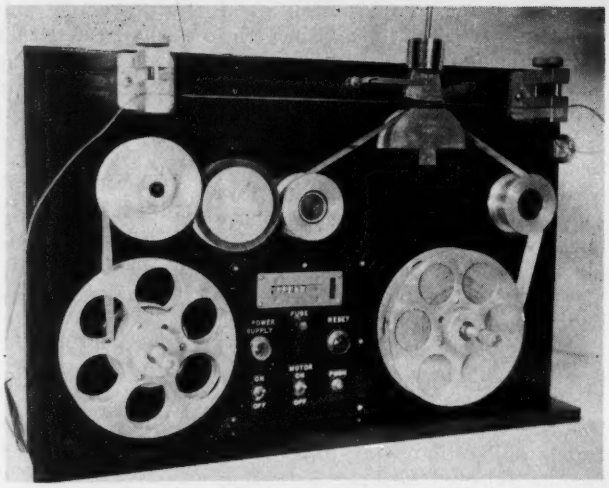


Fig. 1 (left) Squirrel-Cage Type Abrader.

Fig. 2 (above) S.A.E. Type Abrasion Tester.

used. For example, resins of somewhat reduced molecular weight exhibiting lower processing temperatures detract from sandpaper abrasion resistance while having little or no influence on abrasion characteristics of the squirrel cage type. Thus, the same 16 gauge conductor previously discussed can be insulated with .023 mil walls of the given semi-rigid vinyl formulation using two different resin viscosities and give results as follows:

| | SAE Sandpaper Abrader Inches | Squirrel Cage Abrader Cycles |
|---|---|---|
| Using Resin of Sp. Viscosity .52-.58 | 36 | 1062 |
| Using Resin of Sp. Viscosity .43-.47 | 28 | 1016 |

**The** excessive loss in abrasion resistance as measured by the sandpaper device is unquestionably due to the characteristics of the resin at elevated temperatures. The unfortunate feature is, of course, that such resins are substantially easier to process and lend themselves more readily to semi-rigid extrusion techniques.

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**Though** abrasion resistance and low temperature flex have proven to be no problems in the new construction, semi-rigid vinyl insulations have not proven to be a complete panacea of all automotive wiring problems. One of the principal hurdles yet to cross is that of circuit identification. Though the vinyl insulation can be made in 14 distinct and identifiable colors, the use of such a variety of colored insulations creates excessive setup and inventory problems. Some automotive manufacturers require fewer base colors but specify lateral stripes of contrasting colors for identification. Here again, though good vinyl base inks and methods for applying the stripes have been adequately developed, the problems involved hardly lead to an ideal condition. Solution of this problem lies principally in the Electrical Engineering departments of the automotive manufacturers and the Society of Automotive Engineers might well make the simplification of circuit identification a top priority project.

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**Two** more or less important physical properties of the semi-rigid insulation stand in need of improvement. They are:

**(1) Resistance to cutting. In other words, the ability of an insulation to resist physical damage as it is drawn solidly over a sharp thin edge.**

**(2) Resistance to failure under severe compression.**

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**The** old braided constructions had almost perfect resistance to these two types of damage. Both properties are of some importance in the assembly of finished vehicles and their improvement would help to relieve the principal objections to today's plastic insulated construction. The resin and plasticizer manufacturers in conjunction with the vinyl compounders must eventually supply the answer to these questions.

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**In** conclusion, the initial growing pains of the vinyl insulation primary wire are now a thing of the past. As long as present quality levels are maintained and improved, a bright future lies ahead in the automotive wiring field for vinyl plastics. The critical period of question is nearly over and automobile manufacturers can look forward to primary wiring systems with performance they hardly dared dream of a few years ago. Continued improvement in resin and plasticizer manufacture coupled with better compounding and extrusion techniques should bring the industry close to a long sought goal within the next few years.

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# Plastic Coated Steel Wire

by Joseph F. Beegle, Vice President
Hauger-Beegle Associates, Inc.
Chicago, Illinois

**The** coating of steel wire is not a new operation as wire "painting" for the florist trade has been done for many years. Painting of wire was done quite extensively during the war years with the emphasis on the camouflaging of signal and trip wires. Therefore to us who are connected with the wire coating operation, as manufacturers of the protective and decorative coatings, or producers of coated wire, we feel that coated steel wire is entering a new era. An era of new coating materials; of application technique; of surface conditioning prior to coating; and of prime importance, a new era of customer acceptance and demand. It was only a short time ago—a short time because the man's words are so clear in our memories—when he said, "That is very interesting, but who wants to draw wire after it has been coated?" We thought the drawing of coated wire was beyond the point of just being "interesting." It proved that present materials were not only flexible and pliable, but their adherence and hardness were sufficient to enable them to flow with the steel as the wire was elongated and reduced in cross sectional area.

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**Since** our company is the outcome of "wire coatings," those being our original formulations and only products, it would perhaps be interesting to quickly run through some of the events of the last two years. When Standard Industrial was approached by several of its lubricant customers to recommend a protective coating which would adhere over its residue lubricant, we found none we could recommend without reservation. Now as you all know, superintendents just stand around and get in the way when things are running smoothly, and as I was only in the way, I had a new project. It is only fair to admit that the project had definite appeal since my previous employment had been in a paint plant, and paint appeals to my creative nature much more than soap.

Joseph F. Beegle

**Prior to joining Hauger-Beegle Associates, Inc., the author was employed as superintendent of the Standard Industrial Compounds Company. His diversified experience in chemical engineering included services with Insul-Mastic Laboratories, Inc., Resin Division of Interlake Chemical Corp., Trojan Powder Company and Universal Oil Products. He has a degree in Chemical Engineering and holds a valid Mates license in the Merchant Marine.**

**Mr. Beegle presented this paper at the Annual Convention of the Wire Association in Chicago, November 14-17, 1955.**

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**Our** first attempt was the coating of hot galvanized wire. With great optimism we placed a dip tank some distance from the galvanizing frame, with the thought that the residue heat in the wire would be sufficient to evaporate the solvents during a short run to the take-up block. When the hot galvanized wire hit the paint bath only to emerge like a comet trailing a cloud of solvent vapors, every eye in the mill was on it, only to witness the paint literally popping off. The wire was too hot, the evaporation of the solvents too fast and the resulting strains in the film too great. To make a long story short, Standard's harassed paint expert (and they still call me that on occasion) never has been able to get the galvanized wire just the right temperature to give a perfect coating continuously at the take-up block.

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**Our** next public attempt, after several months of surveying the situation, was in December of 1953, when a man who knew how to coat wire made his equipment available to us. Since he had been coating wire for some time, he naturally had definite views on how it should be done. This was opportunity; so we started with an automobile full of samples and a "succeed-or-be-thrown-out spirit." We came back to Chicago with an order, and today we are happy to say this trip developed into a mutually beneficial and profitable experience.

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**That** is how Standard Industrial Compounds entered the protective coatings industry. Last April (1955) a new corporation was founded that I am representing today—Hauger-Beegle Associates, Inc. We hope, our stock-holders and directors, that our name has significance beyond a corporate identity, since we are concentrating our efforts toward the steel industry and its production and maintenance requirements; Hauger, for his familiarity and understanding of your problems and my family name, for whatever prestige the second generation in the coatings industry may carry with our suppliers.

## Coating Materials

**At** the time we became inter-

ested in the coating of wire, most "paints" were similar or formulated to meet the Federal paint specification developed for ammunition cases during the war. This specification, developed for rigid articles, left no latitude for the formulator to adapt its composition to meet the requirements necessary for flexible wire. Rather than competing on a price-service basis to an established specification, we have endeavored to create new plastic coatings applicable to wire. Our materials are based on 100% synthetic resins which give superior acid, alkali and solvent resistance and infinitely greater flexibility. Today our vinyl coatings have been approved for use on specific procurement orders. Our line of wire coatings cover the spectrum from brilliant transparent reds, blues and greens to dull opaque sand color.

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**We** favor the lacquer or solvent-resin system for wire coatings, due to its fast bake-out time and relative simplicity of drying. With the solvent-resin type of materials there is not the direct molecular linkage and resultant limitation on pliability, as experienced with the oxidation setting resins such as the alkyds or thermosetting resins. The lacquer-type resins are thermoplastic and here the disadvantages are compensated by the advantages. The thermoplasticity necessitates cooling the wire before it reaches the first sheave, so that the coating will not crush. During extreme deformations such as "flattening", the thermoplasticity allows greater flow than possible with non-thermoplastic materials, but of course this tendency to soften at elevated temperatures must be considered and compensated for during the operation. Not only are the selection of resins, the pigment-volumes of the solutions and plasticizers important to the coating, but the solvents used play a leading role in the resultant film, as their release governs the orientation of the molecules within the film.

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**All** our products sold to the wire and steel industries have a flash point above 80°F. A two-second evaporation period retaining this 80°F flash point has made our work more difficult, yet it has been warranted by our feeling of responsibility for the customers' safe operation.

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**There** have been so many inquiries for a quench-type coating to be used at the end of an annealer or galvanizer, that we should mention the problems encountered in this type of application. When resin-solvent systems are used as a quench, the wire must emerge from the dip-tank hot enough to evaporate all the solvents. To minimize the shrinkage of the film, a range of boiling points is necessary, thus increasing the tendency to have residue solvent entrapped. Such residue causes the coils to stick together in the bundle. Let us assume that the wire enters the bath at a uniform temperature and the bath is maintained at a uniform temperature and level; assume the solvent loss is so slight as not to affect the solids or viscosity of the solution; then flow-out and drying would still be the victim of atmospheric conditions between the tank and take-up block. The properties of the resin, the "film former" that we seek, should be: high in solubility, fast in solvent release, hard yet pliable, excellent in flow-out, and have a distinct thermoplastic point so that it self-relieves all film strains caused by solvent dissipation, just prior to changing from a soft to a hard film. Theoretically this problem is not difficult if you have five or ten minutes, but here we are dealing with a period of seconds.

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**When** we run our experimental unit at one-hundred-forty feet (140 ft.) a minute, the coated wire is in the drying area for approximately two and one-half (2½) seconds. During this time the coating must be completely devoid of solvent so as not to crush at the first sheave. This speed allows little time to tolerate variables.

## Drying Equipment

**Since** the ideal resin has not been developed, or at least not yet found, we must rely on a dip-tank and force drying in a vertical tower. There are several drying systems in use at the present time. The forced hot-air oven is perhaps the most expensive installation, due to the complexity of the equipment. Gas fired cavity towers are less expensive initially, but they are slightly more expensive to operate, as the hot gases only make a single pass. We favor infra-red heating because of its low initial cost and versatility, quick start-up time and accurate temperature control; it is the only system that allows zone temperature control even when the air is partially recycled. To exemplify the low initial cost, an infra-red oven capable of drying ten wires costs less than $2300 for the tower, the electrical controls and the recycling and ventilating systems.

## Surface Preparation

**Surface** preparation of the wire has received almost as much attention as the coatings to be applied. Naturally the quickest, and often considered the most economical method, is to coat directly over the annealing smut. Although this practice is such as to make most paint formulators scream with anguish, the resulting films are amazing, particularly with a two coat system. Satisfactory florist, box and baling wire may be made over black annealed wire. Manufacturer's wire is more selective and in most instances needs a prepared surface. Here a blue oxide often suffices, produced either by batch or continuous processes. Either type of preparation has its variables; in the batch process the coil has various degrees of oxidation and with the continuous system, the effects of speed, drafts, residue lubricant and shut-downs, give widely varying surfaces. Undoubtedly the most uniformly prepared surface to date is the continuous phosphate etchings of the wire. In this instance the wire is not only cleaned and etched, but has a phospate surface that gives ideal adhesion. Batch phosphating has the same inconsistencies as batch bluing, plus the problem of

(*Please turn to page* 1415)

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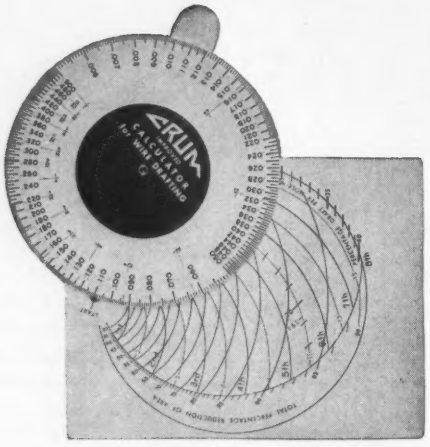


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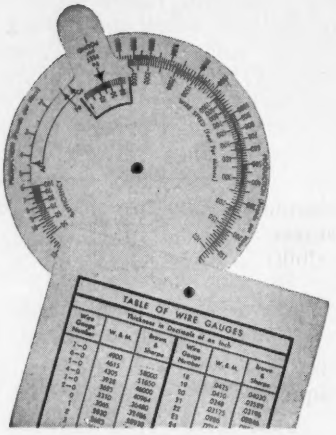


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# Variations in Preferred Orientation And Modulus of Elasticity, In Cold Drawn Music Spring Wire

by H. C. Burnett, Metallurgist and C. J. Newton, Physicist
National Bureau of Standards
U. S. Department of Commerce
Washington, D. C.

**The degree of preferred orientation and the modulus of elasticity were determined for music spring wire at various stages of reduction after the last double lead patenting, and were found first to increase and then decrease with increasing reduction. Methods of specimen preparation, measuring techniques, and a discussion of the results are included.**

## I. Introduction

**The** determination of the basic mechanical properties of cold drawn music spring wire is part of a broad research program being carried on at the National Bureau of Standards under the sponsorship of the U. S. Army Ordnance Corps.

* * *

**It** is well known that the process of cold drawing induces a certain degree of preferred orientation in steel wire. (1)* In body centered cubic alloys of iron the translation and rotation of crystal planes during plastic deformation produces a texture wherein the (110) direction is parallel to the axis of the wire. Although the elastic anisotropy of the iron crystal is well recognized, there has been relatively little attention given to the correlation between the development of preferred orientation and changes in elastic modulus in steel wire and the information available indicates little change in elastic properties due to cold deformation, (2), (3). In the course of investigating the mechanical properties of cold drawn music wire, preliminary tests by the authors indicated a substantial change in the value of Young's modulus of elasticity with increasing amounts of cold reduction and accompanying preferred orientation. It was felt therefore that more specific information pertaining to the degree of preferred orientation and modulus of elasticity at various stages of the drafting would be of value for studying various drawing schedules.

* Numbers in parentheses refer to references at end of paper.

## II. Material

**Commercial** grade music spring wire was used in this investigation. The mechanical properties and chemical composition of the wire met the requirements of U. S. Army Specification Number 48-7-1 for wire cold drawn from Class-B, Open-hearth, 1085 (Special) steel. The chemical composition of the wire is as follows: C, 0.88; Mn, 0.47; Si, 0.30; P, 0.021; S, 0.014 percent. The wire had been given a double lead patent heat treatment after being drawn to a diameter of 0.111 inch. The patented wire was then drawn in eleven reductions to the final wire size of 0.039 inch diameter. The tensile strength at each stage of reduction is given in Table I.

Table I.
Tensile Strength of Wire at Various Stages of Reduction

| Wire Diameter | Reduction in Diameter | Tensile Strength |
|---|---|---|
| Inches | Percent | Lb/in.$^2$ |
| .111 | - | 206,000 |
| .101 | 9.0 | 229,000 |
| .091 | 18.0 | 236,000 |
| .082 | 25.1 | 244,000 |
| .074 | 33.3 | 254,000 |
| .066 | 40.5 | 264,000 |
| .059 | 46.8 | 278,000 |
| .053 | 53.2 | 292,000 |
| .047 | 57.7 | 312,000 |
| .044 | 60.2 | 322,000 |
| .041 | 63.0 | 332,000 |
| .039 | 64.8 | 350,000 |

## III. Specimen Preparation

**Specimens** for the determination of the changes in degree of preferred orientation were prepared from wire of the following diameters: .111, .082, .066, .053, .047, .044, and .039 inch. All of the specimens prepared were in the as drawn condition except one specimen of 0.039 inch diameter wire that had been stress relieved at 750°F for 25 minutes.

* * *

**In** order to obtain sufficient area for use in the X-ray spectrometer, specimens were prepared by cementing together, in a close packed array, a number of short lengths of wire until the cross sectional dimensions were about 3/8 by 3/4 inch. These blocks were then mounted in bakelite for cutting and polishing. The surface of each specimen was cut at some specific angle with respect to the axes of the wires, namely 0, 30, 60, or 90

degrees. After cutting the specimens at the desired angle, they were metallographically polished, etched to remove the cold worked layer resulting from the cutting operation and then lightly polished. A standard specimen, considered to have random orientation, was made from iron powder mixed with glyptol and mounted on a diffractometer slide. [4]

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**No** special specimen preparation was necessary for the determination of the modulus of elasticity at various stages of drawing. Eighteen inch lengths of wire in the as drawn condition and the following diameters were used to determine E: 0.111, 0.074, 0.066, 0.053, 0.047, 0.044, 0.041, and 0.039.

## IV. Experimental Procedures and Treatment of Data

**The** preferred orientation data were taken with a Norelco high-angle diffractometer and associated counting, scaling and recording circuits. The radiation used was cobalt K-alpha, with a tube current of 10 ma at a potential of 27 KVP. Diffractometer scanning speed was one eighth of a degree per minute, with a counting rate meter time constant of eight seconds and recorded chart speed of 30 or 15 inches per hour. A 1° divergence slit was used with a .006 inch receiving slit and a 1° scatter slit. In an attempt to keep operating conditions as nearly constant as possible, the equipment was given a warm-up period of at least 30 minutes and the counting — recording circuits were always carefully standardized, zeroed, and calibrated before use.

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**The** areas under the diffraction curves and above the background levels on the recorder trace were considered to be proportional to the intensities. In some cases measurements were made on the (110), (200) and (211) lines, in other cases only on the (110) and (200). Measurements were usually normalized by dividing by the corresponding measurement from the random powder specimen. In addition, the ratios of intensities of two lines from the same specimen were investigated.

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**In** addition to the intensity, line broadening was also measured on the (110) line. The integrated line breadth was used, being defined as the integrated intensity (area) divided by the peak intensity (height) of a diffraction line. These results were corrected by the Jones' method [5] for non-resolution of the alpha doublet and referred to the iron powder data.

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**The** data for determining Young's modulus of the wire at various stages of reduction were obtained by direct static loading in a vertical plane. Strain was measured with two Tuckerman extensometers mounted opposite each other on the specimen. Mounting in this manner automatically compensates for any bending of the specimen during the initial loading. Ten to twelve additions of load were made on each wire being tested and the increments of strain were obtained by averaging the readings of the two Tuckerman extensometers after each addition of load. These measurements led to a value for E, with a precision indicated by a probable error of $.30 \times 10^6$ lb/in.$^2$

## V. Results and Discussion

**Preferred** orientation: — The early results obtained from specimens of diameter 0.111", 0.066",

(*Please turn to page* 1408)

Table II. Data from Specimens Cut Transverse to the Axes of the Wires

| Wire Diameter Inches | $I_{(110)}$ | $R_{\frac{(110)}{200}}$ | $i_{(110)}$ | $r_{\frac{(110)}{200}}$ | $b_{110}$ | $\beta_{(110)}$ |
|---|---|---|---|---|---|---|
| (Powder) | 2,730 | 6.9 | 1.00 | 1.00 | 63.2 | (ref. zero) |
| .039 | 5,290 | 34.9 | 1.94 | 5.07 | 97.2 | $4.10 \times 10^{-3}$ rad. |
| .044 | 8,752 | 53.6 | 3.21 | 7.77 | 102.2 | 4.65 |
| .047 | 12,307 | 134.4 | 4.51 | 19.50 | 114.0 | 6.03 |
| .053 | 8,515 | 59.3 | 3.12 | 8.61 | 110.9 | 5.96 |
| .066 | 6,016 | 40.7 | 2.20 | 5.91 | 103.0 | 4.80 |
| .082 | 6,858 | 43.5 | 2.51 | 6.31 | 102.0 | 4.64 |
| .111 | 3,357 | 11.2 | 1.23 | 1.63 | 73.6 | 1.36 |
| .039 * | 10,980 | 85.0 | 4.02 | 12.34 | 80.7 | 2.22 |

$I_{(110)}$ = intensity (area) of (110) line

$R_{(110)} = I_{(110)}/I_{(200)}$

$i_{(110)} = I_{(110)\ wire}/I_{(110)\ Powder}$

$r_{\frac{(110)}{200}} = R_{wire}/R_{powder}$

$b_{(110)}$ = integrated breadth of line as directly measured

$\beta_{(110)}$ = line broadening as corrected by Jones' method

* Stress relieved at 750°F for 25 minutes

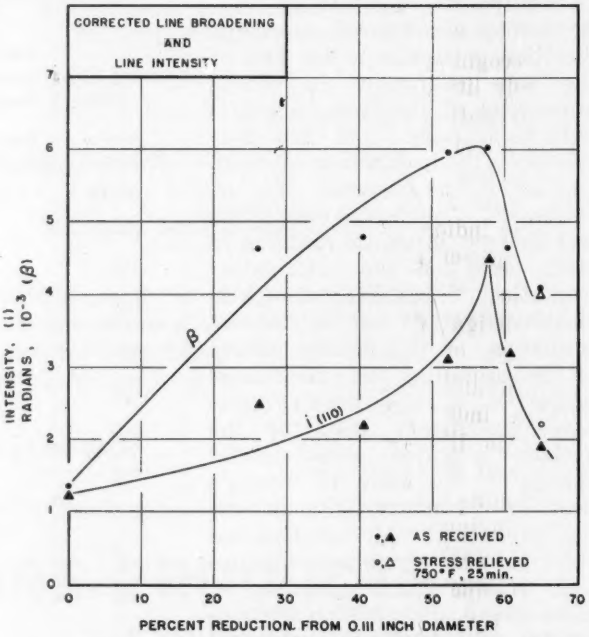


Figure 1. Corrected line broadening and intensity of the diffraction from the (110) plane of music spring wire at various stages of reduction. Specimens had been cut transverse the axes of the wire.

# New Wire & Cable Developments Revealed at NEMA Meeting

**The** latest developments in the wire and cable industry were discussed at the September 26-28 meeting of the **National Electrical Manufacturers Association's Wire and Cable Section** before eighty-five of the industry's executives at Skytop, Pennsylvania.

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**Interest** was focussed on a discussion by **William A. Meissner, Jr.,** on the copper supply situation.

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**Mr.** Meissner, who is Deputy Director, Copper Division, Department of Commerce, said "It is increasingly apparent that the entire copper situation can be summed up in one word: Price. There is sufficient copper physically available to meet requirements but there is not sufficient low price copper to meet them.

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**"This** Administration does not favor price controls, nor do we believe that you do. We believe in free enterprise in the scheme of things, and the fact that your competitor is able to obtain more 43¢ copper than you is a matter over which we have no control.

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**"I** want to express our sincere appreciation for the fine cooperation we have received and we are especially appreciative for the fact that you are sponsoring our Quarterly Report for the coming year.

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**"We** have made an attempt to work with NEMA on all problems concerning the wire mill industry, and at present are working out a program in regard to surplus disposals."

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**The** aluminum supply situation was discussed by **Ray G. Boyd** of **Kaiser Aluminum & Chemical Sales, Inc.** The suitability of Aluminum for use as magnet wire, and as a building wire conductor was also explored.

## Performance Standard for Magnet Wire

**A** performance standard for magnet wire was discussed by **R. L. Reading** of the **Belden Manufacturing Company.** He said, "In view of the numerous materials now available that are considered suitable for magnet wire film coatings, and recognizing the impracticability of issuing standards for each of these new film coatings, a NEMA Wire and Cable sub-committee has been formed to investigate the possibility of writing performance standards for the various thermal classifications (Class A, Class B, Class C).

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**"As** an initial step, a performance standard is being written for film coated wire satisfactory for operation at Class B temperatures."

## Aluminum and its Suitability for Use As a Magnet Wire

**Dr. George Perkins** of the **Reynolds Metals Company** in discussing the growth of aluminum usage said, "In the magnet wire industry aluminum has proven to be technically sound. Manufacturing problems have been met and solved, often in a manner that resulted in improved operations.

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**"Forming,** joining and assembly have been demonstrated as thoroughly feasible. Operational characteristics of aluminum wound devices have been proven in service."

## Changes in Bureau of Mines Schedule 2-F

**The** chief changes in the new Bureau of Mines Schedule 2-F entitled, "Electric Motor-Driven Mining Equipment Junction Boxes," were reported by **E. G. Sturdevant,** chief engineer, **United States Rubber Company.** He said the changes that interested the wire and cable industry are "that it permits the use of a ground trip relay as an alternate to a grounding conductor in a cable for keeping the frames of underground equipment at ground potential, and that it provides for a procedure to govern the use of unapproved or experimental equipment in gassy mines for a six-month period. This trial period may be extended to one year by approval of the Bureau of Mines."

## U.L. Performance Tests For Flexible Cords

**Fred Paradise** of **Underwriters' Laboratories, Inc.,** Chicago, reported on U.L. Tests "which simulated the abuse conditions that flexible cords would suffer in actual usage. The data that will be obtained will be used as a basis for selecting appropriate cords for various types of electric appliances. This work may ultimately affect U.L. standards and cord designs."

## Trend Towards Super High-Tension Cables

**In** discussing the trend towards super high-tension cables, **Robert J. Wiseman,** of the **Okonite Company,** said, "The electric power supply forecasts show that by 1965 the generating capacity will be double the present amount, or a total capacity of about 200,000,000 kw. A large portion of this increase will be in the generating units of 100,000 kw and over, in many cases it will go as high as 200,000 to 350,000 kw. These large amounts of power will be transmitted most efficiently by voltages of 138 kv to as high as 345 kv, and possibly 400 kv.

"**The** electric cable industry is now studying methods for improving the materials used for insulation. It is reviewing the manufacturing methods employed, and is investigating the thermal and physical properties of the soil surrounding the cables to find how to get the highest possible current-carrying capacity out of the power circuit. These studies will take a few years. After they are completed, the electric utilities plan to conduct tests that duplicate operating conditions so that it will be possible to meet the doubled capacity that forecasts show for 1965."

## The Outlook For The Future Supply of Asbestos

**The** current availability of asbestos textile fibers and the extensive developments made by Canadian mines to increase the supply of these fibers was discussed by **Myril C. Shaw**, secretary of the **Asbestos Textile Institute.** He gave a brief analysis of those asbestos fibers particularly applicable for the manufacture of textiles that are important to the electrical industry.

## Activities of NEMA Wire And Cable Committees

**A. D. R. Fraser**, chairman of the NEMA Wire and Cable Section, and president of the **Rome Cable Corporation,** discussed the expanding activities of the Section's committees. The Industrial Relations Committee, the Accounting Committee and the Statistical and Market Research Committee are among the new activities which are expected to benefit the industry.

## Modern High Voltage Rubber Insulation

**Rubber** insulated cables, especially in the 2 to 35 kv range, are being used more and more as the electrical industry expands. It is anticipated that the output for Class I systems in the United States will approximate 900 billion kw-hrs in 1963," stated **G. J. Crowdes,** Chief Engineer of **Simplex Wire & Cable Co.** "Such a load will need efficient design of the electrical, mechanical and thermal characteristics of rubber insulated power cable in both industrial and utility circuits."

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**Mr.** Crowdes provided "comparative data between the newer synthetic rubber butyl, and both natural and oil base insulation, the quality criterion of the past." He emphasized the relative performance of these materials in various environments and under various deteriorating situations.

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**He** said that many comparative tests and field experience show that butyl and oil base rubber differ in their properties. Butyl insulation has greater resistance to heat and aging, deterioration from moisture, ozone and corona. The dielectric strength of the two materials seems to be reasonably close. "The dielectric constant and power factor are lower for the butyl insulation and the resistivity is higher," he said. "Finally, these properties permit the butyl insulated cable to operate at higher temperatures for normal, emergency and short-circuit loading."

## IPCEA Dimensional Tolerances Of Extruded Insulation

"**For** three years the Insulated Power Cable Engineering Association has been studying the performance characteristics of extruded insulation on wire from the point of view of dimensional tolerances," Mr. Crowdes said. "Many measurements were made and analyzed statistically. From these, a distribution and behavior pattern was derived representing the performance of the industry regarding the control of dimensional properties of insulated wire. After a second series of measurements was made, the original statistical study was reviewed. As a result, an IPCEA standard was proposed for dimensional tolerances. It is getting a six-month trial.

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"**Basically,** the only dimension considered critical is that of minimum wall thickness. The standard provides a sampling plan, a method of measurement, and a suitable table for interpreting the results.

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"**The** use of this standard will provide both manufacturer and the user more information regarding the product that has been available before and with considerably less inspection."

## Thermal Rerating of Electrical Equipment

"**Revision** of AIEE Standard No. 1, when completed, will have a profound effect upon all electrical design," stated **Ralph Hall,** chief engineer of the **Phelps Dodge Copper Products Corporation.** "This standard pertains to the 'General Principles on which Temperature Limits are Based in Rating Electrical Machines and Other Equipment.' The revision will incorporate basic performance tests as a measure of the suitability of insulation systems at higher temperatures."

## Proposed Changes in 1956 NEC Affecting Wire and Cable

**Proposed** changes in the 1956 National Electrical Code as they affect wire and cable were discussed by **C. W. Zimmerer,** associate electrical engineer, **Underwriters' Laboratories, Inc.,** New York, N. Y. He said that the proposed changes will include a complete re-arrangement of the sections relating to wire and cable, for the purpose of making this information more usable.

**In** addition, the following new items are among the more important proposals recommended by the Code-Making Panel No. 6:

1. **A section on temporary wiring.**
2. **A heat-resistant, rubber-insulated wire (Type RH-90) for use at 90C.**
3. **Establishment of maximum temperatures for copper and aluminum conductors.**
4. **Tables for the current-carrying capacity of insulated aluminum conductors.**

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A proposal for the recognition of a new moisture and heat-resistant thermoplastic insulated wire

(*Please turn to page* 1416)

# Improving Productivity in a Wire Mill

by C. C. Tappero
Superintendent, Wire Mills, Pueblo Works
Colorado Fuel and Iron Corporation
Pueblo, Colorado

This paper was delivered at a meeting of the American Iron and Steel Institute in San Francisco on October 21, 1955 and is published here through the courtesy of the Institute and with the permission of Mr. Tappero.

Mr. Tappero graduated from the Colorado School of Mines in 1935 with a degree of Engineer in Metallurgy. After some work on non-ferrous metallurgy, he entered the Industrial Engineering Department of C. F. & I. and later became Assistant Superintendent of that department. Subsequently he was made Superintendent of Combustion and then promoted to his present position.

**Normal** reaction to demands for increasing production is to immediately determine and request the additional equipment required to fulfill such demands. Similarly, replacement of existing equipment is often considered the only solution to improving costs.

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**Frequently** both increased capacity and lower costs can be obtained by relatively smaller expenditures to improve productivity of existing equipment.

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**Often** purchase and installation of new high speed equipment fails to materialize into increased production and lower costs due to poor operating methods resulting in excessive delays.

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**Considerable** capital expenditures can be saved along with assuring proper return of new equipment if more detailed studies are made of existing equipment and methods. Such studies will indicate the potential capacity of existing equipment, changes in design required to increase production, method improvements necessary to obtain maximum capacity of the equipment; or will substantiate requests for additional units in the event the present equipment is at full capacity. In this event, detailed studies of existing equipment will assist in selecting the most efficient design and layout to provide maximum production and minimum cost.

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**Analysis** of the overall machine efficiency of a unit will indicate extent and type of studies required. Machines which are producing close to maximum capacity, based on speed of the machine, will require studies of feasible changes in design to provide greater speeds, along with studies of operators' work load to determine if the increased production can be handled by the assigned personnel. Units where overall efficiency is low will require studies to determine reasons for low machine efficiency and potential capacity of the units. Studies of low efficiency units should be made to determine frequency and extent of all major and minor delays. Studies of major delays, such as mechanical, electrical and materials, are best made over a long enough period to determine which delays are recurring and corrective. Daily delay reports completed by each machine operator, coupled with maintenance department reports as to type of and extent of repair made on machine breakdowns will provide basic data for analysis of mechanical and electrical delays.

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**Delays** reported in this manner will highlight recurring delays, such as, frequent failure of a machine part, abnormal time spent in size changes and waiting for materials. These delays will account for a varying portion of the total. The remaining delays which preclude full machine utilization are usually short in duration and occur frequently throughout the day. Delays of this nature can be accurately recorded by time study. During such studies work loads of operating personnel should be obtained even though they may have been established in the past for purposes of setting incentives.

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**An** analysis of these studies and reports will indicate the reasonable amount of additional production that can be obtained by elimination of controllable delays. Decision can then be made whether the potential increase in production will satisfy the current demand, or additional equipment is required. Elimination of controllable delays is of greatest importance when demand for additional production is insufficient to justify or absorb the production of a new unit. Elimination of delays in this case, in addition to saving capital investment, results in lower operating costs.

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**While** delays will vary with each type of operation particularly in their magnitude, they usually are of the following general types:

**Mechanical and Electrical**
**Materials**
**Size Changes**
**Operating**

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**Methods** of eliminating some of the above delays are usually quite obvious. Repeating mechanical or electrical failures when called to the attention of engineering or maintenance departments can usually be eliminated by changes in design. Often, and as an operator I am reluctant to admit that, very often many mechanical and electrical delays can be eliminated by operating personnel. Such as, failures from insufficient lubrication and parts or tool breakage caused by poor set ups. Maintenance department reports as to type and

reason for repair will help correct such breakdowns.

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**Supply** of raw materials and removal of finished product is often overlooked as a major factor in lost production. When many units are being served, such as in a drawing room, nail mill or fence department, the total loss in production from the accumulated short delays experienced by many units throughout the day can be the equivalent to the production of several new machines. It is possible that the purchase of a fork lift or tractor can gain the equivalent production of one or more drawing machines, costing many times as much. Further the addition of more drawing machines without correcting the transportation condition would result in more frequent and greater delays, resulting in little gain in production from the addition of new machines.

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**Size** changes are usually considered a normal operating necessity. Critical studies of frequency and magnitude of changes may often reveal that many can be eliminated by improved scheduling methods.

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**Delays** credited to personnel operating a machine are generally of the greatest magnitude even though each occurrence may be of small duration. The delays I have reference to are those that occur even though the operator is fully qualified in his job and is endeavoring to produce all he possibly can, such as on operations covered by an incentive. These delays are caused by a high work load which precludes assigned personnel from accomplishing all the work necessary to obtain maximum machine utilization. They are more predominant when an operator is assigned to two or more machines, such as, drawing machines or a nail set of several machines. They are also dominant on units which consume many wires at a time, such as fence or welded fabric machines. The particular type I wish to emphasize are those that cause a machine to be stopped when the operator is busy performing other necessary work. Usually these delays are discounted because it is apparent that the operator is working and unable to avoid the delay. Some examples of these delays frequently seen about a Wire Mill are as follows: A helper or a nail set is in the process of loading a reel with wire, meanwhile the wire on another machine is about to run out. In order to preclude the second machine from running without wire and probably damaging the carbide dies, he leaves the first machine and shuts down the second, which remains down until he finishes servicing the first machine.

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**An** operator on a fence machine can manage to reload one reel at a time; but when two reels come up at the same time, his machine must be stopped.

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**Production** lost due to these delays can be quickly saved by additional personnel. However, this solution results in excessive direct labor costs, since the magnitude of the delays will seldom justify an additional operator or helper. More economical solutions can be developed by carefully reviewing the work being performed by the assigned personnel. At this point detailed time studies are of most importance. Time studies made for the purpose of establishing incentives often do not contain all the data desired. Therefore, special studies with view to developing the following data should be made. Data obtained should show how much time is spent and how frequently on the various work elements necessary to maintain a machine in operation, amount of time the employee has when he is caught up on his work and could prepare additional material for his machines, if the facilities were available, and what work elements are performed which require heavy physical work that exhausts and slows down the employee. The latter are the most important and generally the key to improving an operation. Critical examination of these work elements may indicate that some of them can be eliminated by changes to equipment. All should be examined with view to reducing work load of operating personnel. In the example previously cited of the nail helper, it is obvious that by doubling the size of the wire bundle, synchronization delays would be cut in half. While in the case of the wire drawer in-

Figure 1

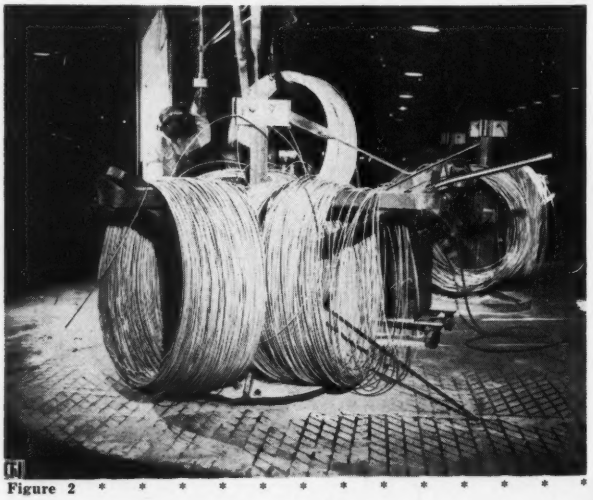

Figure 2

creasing the weight of the rod bundle is not feasible; however, providing flips which can hold more bundles will permit him to preload and weld additional bundles as time is available. In both of the above cases the work can be completed faster and with less physical effort if hoists are provided to do the lifting.

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**Providing** mechanical aids to enable the operator to perform his work faster and with less fatigue will enable him to complete his work and remain ahead of his machines rather than have his machines stopped waiting for him. How far installation of such aids is carried will depend upon their cost and time to be gained particularly on existing equipment. On new installation, they should be given maximum consideration to enable manning the equipment with the minimum size crew.

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**Examples** of how production has been increased on some units may be of interest.

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**Figure** 1 shows an old fixed speed drawing machine finishing at 870 feet per minute. Intermediate blocks on this type of machine can not be individually clutched out to reduce build up. After the machine finished about 1000 lbs. of wire, build up of wire on the intermediate block will reach the top. It was then necessary to cut off the rod at the ripper, run out the wire on the intermediates and restring the machine. Time lost in restringing, if spent operating, was sufficient to produce about 5% more wire. At a small cost, our Pacific Coast Division designed and built the 22″ monoblock, seen on the right side of the original 16″ block machine. The original finishing block was replaced by an intermediate which feeds the new finishing block. Speed of the added block is 1150 ft. per minute. Since the finishing block is individually driven, it can continue to be operated to draw off wire built up on the last intermediate block after the original machine is shut down due to build up. The original machine can now be restrung after the build up is reduced without stopping the finishing block and losing production. This coupled with higher finishing speed, has resulted in a net increase in production of about 30%. Total cost of equipping four such machines to obtain the equivalent production of an additional machine was approximately 25% of the cost of a new unit.

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**Figure** 2 shows a rod flip which enables the wire drawer to load three bundles of rods. While normally it is only necessary to load a second bundle and weld it to the bundle being drawn, this flip permits loading a third bundle, when the operator is free to do so, which precludes synchronization delays later, in the event he is busy performing other work. Use of a hoist in this case is dictated by the weight of starting bundle; however, if the bundle was within the weight that could be manually handled, a hoist would probably enable the wire drawer to produce more.

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**Figure** 3, of a patenting unit also highlights the importance of layout and reserve supply of materials prepared for processing. This unit is laid out so that take-up blocks and pay-off reels are adjacent to each other, enabling the operator to have both under observation at the same time and reduces the area he must cover. Originally the reels could only hold one bundle. Limited floor space precluded using spare reels. When a reel was about to run out the operator took the remaining loops off, loaded on a new bundle, welded it to the previous bundle and replaced the remaining loops on the new bundle. It was necessary that he perform this work just before the reel ran out. Block efficiency was low due to wires being lost when reels or blocks required servicing at the same time and due to tangles throughout the unit. By

Figure 3

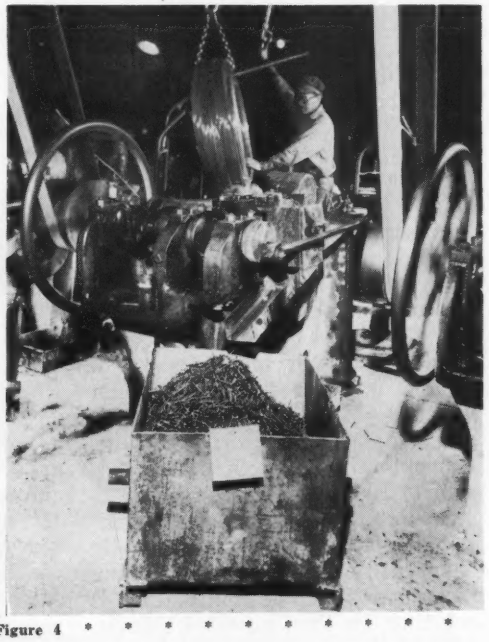

Figure 4

a small revision which consists of installing removable pins about midway down the reel, a second bundle can be placed on the reel even when the reel is turning. This enabled the operator to preload the reels whenever he has time. He is now confined to the reel only long enough to make the final weld at the time the first bundle runs out. As can be seen, many are loaded with two bundles, one on the base and the second resting on the pins. Time is now available for the operator to keep rods straightened out to eliminate tangles. This simple change has increased the block efficiency to where it is close to 100%.

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**Figure** 4 illustrates the results of eliminating as much physical work as possible. Previously reels on these nail machines were loaded manually with 150 to 200 lb. bundles of wire. Nails from the machine fell into a small tote box which the helper dumped into a nail buggy. Installation of a hoist and changes to the reel permitted doubling the weight of wire bundle. Designing a tote box that could be placed under the nail chute eliminated physical loading of nails. This type of tote box, which can be transferred by fork truck, replacing manually pushed buggies resulted in economies in transportation labor. Nail machine helpers are now able to service 50% more machines than previously. They have more time available to check nails for quality, lubricate and check their machines. Nail set machine efficiency has increased considerably as a result of fewer synchronization and mechanical delays.

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**When** the cost of increasing production of a unit is excessive in proportion to the increased production obtained or when the possible increased production will not meet the demand, a new unit is indicated. Studies made of the old unit can assist in preparing an efficient layout and design for the new unit. Our old nail bluing equipment consists of 100 lb. capacity drums. The operator filled a container with nails from a hopper, manually charged the nails into a drum, placed on the cover and started it rotating. He then repeated this operation with a second drum. When bluing was completed, he removed the nails using a hoe to pull them into a container. By means of a hoist he transferred the finished nails and dumped them on a packing table and then repeated the cycle. After cooling, nails were packed into cartons and placed on pallets by a helper. Temperature in the vicinity of the bluing furnaces was high, work load heavy. Another drum was available and the work load could have been reduced a limited amount. However, studies indicated that synchronization delays and the remaining work load would preclude any appreciable increase in production. Therefore, to meet the demand for blued nails a new unit was required.

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**Design** and layout of the new unit was made with full consideration of the adverse condition in the old unit from standpoint of work elements, physical effort, heat and design of equipment.

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**Figure** 5 is of the new unit. Bluing is done in a continuous furnace instead of the batch type. Nails are fed into one end of the furnace from a hopper by gravity and vibration of the bottom pan of the hopper eliminating manual charging. After being discharged from other end, nails are conveyed to an air cooling drum. The direction of air is opposite the flow of nails which carries the heat away from the operator's work area.

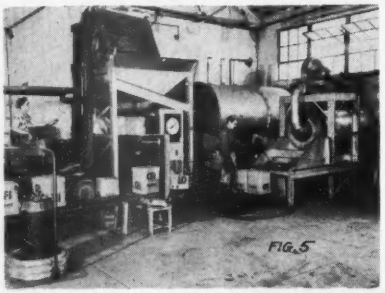


**Figure 5** * * * * * * * * * Nails leaving the cooling drum fall on a packing table. By means of a vibrator attached to the table, nails can be made to slide down and drop into the two nail containers setting on a shake platform. The table is equipped with a gate which can be closed when the operator is changing containers or occupied with some other work.

Raising filled containers to a roller conveyor on the same elevation as the scale is done by a hydraulic lift. In the picture the lift is in the process of raising two filled containers. The operator checks the weight of the nails on the scale, adds or removes nails to reach the desired weight and then moves the containers along the conveyor to a tying station. Here he closes the containers with tops, which he has stenciled with data as to size and type of nail, and wire ties the containers. Next he performs the only physical work in the operation, which is to lift the containers from the conveyor and place them on a pallet. You will notice that the layout is again in a horseshoe pattern so that the operator's work area is reduced and he can observe all vital operations from each work station. All controls are adjacent to the work area so that he may regulate the flow of nails into the bluer, its temperature and speed from a position where he can see the effect of each change. Results of designing into the unit mechanical means of eliminating physical work enables the operator, without the assistance of a helper, to perform all the work involved in operating this bluer. Production from the unit is exactly double that of the old unit.

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**While** emphasis has been placed on eliminating physical work to enable an operator to perform his work faster, thereby freeing him to reduce delays or perform more productive work, it is fully appreciated that many other delays may be inherent in the operation. Usually other delays along with mechanical and material delays are brought to our attention, either by the operators since they may limit their earnings on incentive jobs, or by the maintenance foreman on recurring breakdowns. However, when the operators have a full work load, and know it, they feel that nothing can be gained by eliminating delays; and when we observe such an operation, we are prone to think that it is very efficient. While on the other hand, when operators are seen caught up on their work and observing the operation, we are inclined to think that the job is over manned. Frequently in both cases the opposite is true.

### Townsend Moves to Ellwood City

**The** Townsend Company has moved from its old plant at Fallston to a modern $1,000,000 factory on the outskirts of Ellwood City, 10 miles away.

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**When** the firm's 750 employes returned to work August 15th from their two-week annual vacation, the 175 finishing department employes reported at the new location where they found their 622 machines installed and ready to operate.

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**The** 139-year-old Townsend Company can produce 60 million rivets, nuts, bolts and other kinds of industrial fasteners and cold-headed parts in a single day. They are used in almost every conceivable manufactured product, such as automobiles, trucks, buses, aircraft, trains, refrigerators, freezers, stoves and washing machines, and in construction.

**The** move is the first in 127 years for Townsend. It was in 1828 that the firm moved its plant from Pittsburgh to the community of Fallston, just across the Beaver River from New Brighton, Pa.

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**F. R. Dickenson,** president, said the firm launched the building program because the old plant was antiquated and had no space for expansion. The Fallston property will be sold.

★ ★ ★

**The** new plant is only the first phase of a $4,500,000 building program on the 115-acre site located on a bend in the Beaver River. The first unit housing the finishing operations, such as thread rolling, slotting, heat treating and plating, contains 81,000 square feet under one roof. The completed program calls for 321,000 square feet of working space.

★ ★ ★

**Mr.** Dickenson said asking employes for their suggestions paid off in several valuable ideas that will make the new plant more efficient.

### Allegheny-Ludlum Expansion at Dunkirk

**An** expansion program expected to amount to about $1,000,000 in the Dunkirk plant was announced by the **Allegheny-Ludlum Steel Corporation.**

★ ★ ★

**Walter R. Breeler,** Dunkirk plant manager, states that plans are being drawn for a two story stainless steel office building and for expansion of the plant for production of titanium steel alloy.

★ ★ ★

**Each** of the projects is expected to cost about $500,000. The new office building will be air conditioned and will provide space for nearly 200 workers. The construction will be the first major building operation at the plant since construction of the Brigham Road building by the Federal Government during World War II.


MICROMETER PRECISION MICRO-WELD TRADE MARK REGISTERED

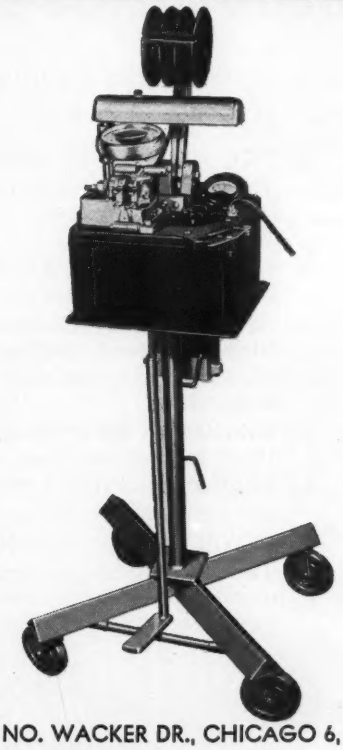
**MODEL S.E.M.T. MICRO-WELD BUTT WELDER**

This welder was designed and developed expressly for welding all types of fine wire: Aluminum, Copper, Brass, Bronze, Steel and Steel Alloys, ranging in size from .005" to .020" diameter.

Unit design of frame, transformer and power sub-assemblies permit other range of sizes to suit requirements.

Equipped with a temperature indicating annealing and tempering device, voltage regulator and meter to compensate for voltage fluctuation, wire cutters, extra large 5" diameter magnifying glass, fluorescent light and extension cord. Welder can be supplied for bench mounting, or mounted on 4-wheel truck.

The adaptability of this unit for welding all types of wire, either ferrous or non-ferrous, in sizes from .005" to .020" diameter, makes it ideal for the fine wire manufacturer.



**MICRO PRODUCTS CO.,**

20 NO. WACKER DR., CHICAGO 6, ILL.
Telephone: STATE 2-7468

### Chain Link Fence On Parkway Adds Safety

**The** outstanding safety record of the Garden State Parkway in New Jersey will get added support by the completion of 18 miles of safeguard fence along its borders made by the Cyclone Fence department of **U. S. Steel's American Steel and Wire Division.**

★ ★ ★

**Protection** will be afforded to pedestrians, as well as automobile drivers.

★ ★ ★

**Effective** but inconspicuous policing will be carried on by the fencing, which blends with the landscaping on each side of the Parkway.

★ ★ ★

**Climbing** of the barrier is difficult because of the small two-inch mesh in the chain link wire fencing. Animals are prevented from going through by the small apertures.

★ ★ ★

**Ten** thousand posts support the fence, which is five feet high. Each is firmly footed in three feet of concrete. They are pipe type posts, two inches in diameter, except for the 2½ inch terminal posts. Running along on top is a pipe rail 1⅝ inches in diameter. Wire bands hold the fencing to the posts and railing.

### Booklet on Making Wire Rope Offered

**"How** Edwards Wire Rope is Made" is the title of a new 28-page illustrated booklet issued by **E. H. Edwards Co.**

★ ★ ★

**The** booklet describes and illustrates the various steps involved in the manufacture of wire rope. These include heat treating, cleaning, wire drawing, reheating, recleaning, final drawing, galvanizing, testing, tagging, storage, spooling, stranding and closing. The booklet presents a detailed description of the development of "endless" wire of uniform structure into the finished wire-rope.

★ ★ ★

**The** foreword of this booklet points up an important fact that is often overlooked. It is that you have to know the qualities built into a rope in order to know the kind of service you can get out of it.

★ ★ ★

**The** booklet may be obtained by writing, E. H. Edwards Co., Butler Road & Industrial Ways, South San Francisco, California.

### $10 Billion Market For The Electrical Industry Seen

A minimum market of $10,000,-000,000 has been estimated for the electrical industry as an important by-product of the goal set by a dynamic new organization dedicated to the task of bringing the nation's substandard housing up to livable requirements.

★ ★ ★

**The** recently established nonprofit, nonpartisan organization is


# WHAT MEMBERSHIP IN THE WIRE ASSOCIATION OFFERS YOU:

1. **WIRE & WIRE PRODUCTS**—For One Year. The official publication of The Wire Association, covering The Wire Industry; its Metallurgy, Technology, Research, Processes, Machinery and Personnel.
2. **THE ANNUAL BUYERS GUIDE & YEAR BOOK OF THE WIRE ASSOCIATION.** The Year Book Section contains: Constitution and By-Laws of The Wire Association; Details of year's meetings, etc.; List of Members, Index to Papers and Articles in WIRE & WIRE PRODUCTS.
3. **QUESTION AND ANSWER SERVICE.** Answers to technical and operating problems direct by mail. Available to members only.
4. **ANNUAL CONVENTION.** Technical sessions covering metallurgical and manufacturing problems involved in the production of ferrous and non-ferrous wire, electric wire and cable and other products fabricated either wholly or in part from wire. Plant inspections.
5. **REGIONAL MEETINGS.** Attendance at the regional meetings which include Local Plant Inspections, Technical Sessions and Discussions.
6. **PERSONAL CONTACTS.** Both at Annual and Regional Meetings, and throughout the year, for interchange of helpful information.
7. **INFORMATION SERVICE ON MACHINERY, EQUIPMENT AND SUPPLIES.** The Technical, Catalogue and Correspondence Files of the Wire Association hold the answer to practically every "Where can I buy" problem. This service is available to members without charge.

**ANNUAL DUES: $15.00**

**For booklet giving detailed information and a membership application card, address**

**RICHARD E. BROWN, Executive Secretary**

**453 Main Street** • **Stamford, Conn.**

ACTION—the American Council to Improve Our Neighborhoods.

★ ★ ★

**According** to ACTION, some 20,000,000 of the 45,000,000 non-farm homes in the United States today are in need of major repairs, while five million are rock-bottom slums. The ACTION program is designed to stimulate the rehabilitation or replacement of substandard housing and the conservation of the housing now in good condition. Success of the program will obviously have a tremendous effect upon the electrical industry, far exceeding the $10 billion for minimum electrical requirements.

★ ★ ★

**Elimination** of substandard wiring alone will greatly increase the demand for electrical appliances and power. Industry representatives pointed out that during the next ten years an estimated $90-billion is expected to be spent on new appliances which will create a demand for an additional five billion dollars' worth of new generating facilities. ACTION estimates that as much as $37½ billion of these projected appliance sales depend upon bringing the existing housing inventory up to minimum, safe wiring standards.

## Lubricant Manufacturer Opens Plant in Germany

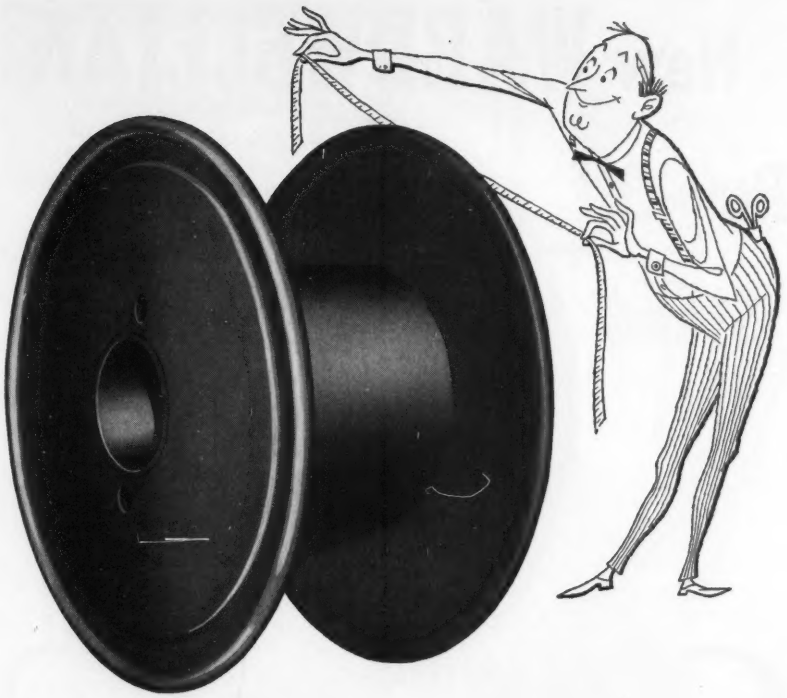
A new plant for the production of Molykote Lubricants in Europe has just been opened at 71 Arnulfstrasse, Munich 19, Germany, it was announced recently by **Alfred Sonntag,** president of **The Alpha Molykote Corporation,** 65 Harvard Avenue, Stamford, Conn.

★ ★ ★

**The** opening of the Munich plant was necessitated by the tremendous acceptance of molybdenum disulfide lubricants by European industry.

★ ★ ★

**The** new factory will support the efforts of ten **Molykote** distributors in Austria, Belgium, Denmark, England, France, Germany, Holland, Italy, Sweden and Switzerland. Heretofore, Molykote Lubricants were exported to Europe from the Alpha Molykote factory in Stamford.

Made To Your Measure

REELS, SPOOLS AND BOBBINS

Just as a tailor skillfully measures and shapes a suit to fit each meticulous customer, Apco Mossberg engineers design and construct steel reels, spools and bobbins for the wire industry.

Trueness and balance are all important in this age of high speeds, and Apco Mossberg reels are manufactured to extremely close tolerances established during more than fifty years of service to the wire industry.

Our engineering and service departments are ready to go to work for you. Tell us your problem . . . we will make suggestions and offer solutions without obligation. Write us or call collect . . . Attleboro 1-0340.

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ATTLEBORO, MASS.

# New WARDWELLIAN®

# Pay-Off Stand

**An improved Pay-Off Stand for delivering small diameter soft drawn wires from supply spools in the process of winding single or multiple ends on metal spools as supplies for WARDWELL RAPID BRAIDERS and other uses.**

Maximum diameter wire approximately .012.

Due to the system used the wire strands can be payed off rapidly to deliver properly to the winding machine.

Supply spools are mounted in substantially vertical position to allow the strands to pay off over the spool heads.

Each strand of wire feeds around an individual tensioning roll adjustable for securing any desired tension.

This method of applying tension to each individual strand results in uniform tension on all strands.

A cylindrical guard surrounding each spool prevents interference between the strands during ballooning as they unwind from the spools. Guards can be raised and lowered for easy mounting and removal of supply spools.

Guides for wires are made of long-wearing Heanium material.

An auxiliary guide-stand for feeding strands to winder furnished with each Pay-Off Stand.

Stand will accommodate eight spools or can be extended for twelve supplies at slight additional cost.

Maximum diameter of supply spool head 8".

A standard set of eight spool-caps furnished with each stand.

Spool dimensions including diameter of bore must be furnished when ordering.

Weight of standard type for eight supply spools approximately 270 lbs.

*Complete information on request*

Ask about our other machines for braiding, shielding with wire, tape serving, yarn serving, asbestos serving, paper serving, armor serving and resistance wire serving.

**WARDWELL**
BRAIDING MACHINE CO.

Central Falls
Rhode Island, U.S.A.

*Representatives for Europe, British Colonies and Dependencies*
JAMES MACKIE & SONS, LTD., BELFAST, IRELAND


## Boron Carbide Handbook

A "Handbook on Boron Carbide and Elemental Boron," just published by **Norton Company,** Worcester 6, Mass., provides 16 pages of technical information on materials made by the company for use in the atomic energy field.

★ ★ ★

**Included** in the table of contents are the following: Boron for Neutron absorption, technical grade boron, properties of boron, commercial grades of boron carbide, radiation damage to boron carbide, bonded boron carbide, boron nitride, metal borides. These and other subjects are fully described in a manner which will make this illustrated booklet a useful reference for scientists and technicians in the atomic energy field.

## "Industrial Furnaces"— A New Book

**W. Trinks** has prepared a new third edition of "Industrial Furnaces," Volume II, for John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Considered the "furnace man's bible," the book has been more than half rewritten to incorporate the final word on furnace know-how.

★ ★ ★

**Concentrating** on fuels, furnace types, and furnace equipment, Volume II of "Industrial Furnaces" delves into all phases of operation as they are known and handled today. Mr. Trinks supplies more than fifty new items in this edition, with 117 new illustrations and an entirely new chapter on safety measures.

★ ★ ★

**The** volume discusses many new burners and furnace types, improved mounting of electric heating elements and practical methods of calculating them, the application of protective atmospheres, the latest information on fuels and electric energy, and labor-saving devices for moving material into, through, and out of furnaces. New data on tar-pitch, direct resistance heating, up-to-date facts on resistors, recent types of temperature-control instruments, link-belt

chains and woven-wire belts, a comparison of fuels and furnaces on six bases, and the effect of local conditions on selection of heating methods are among the many points carefully selected and explained by the author. In addition, new charts for carburization and decarburization of steels of various carbon contents are supplied, as well as details on the properties and cost of liquefied petroleum gases, salt baths, charging levers, hearth rollers, and other items of operating value.

★ ★ ★

**The** fourth edition of "Industrial Furnaces," Volume II, contains 358 pages and is priced at $10.00.

### Heat Treat Review

**A** new issue of 'Surface' house organ features two articles on automation for modern heat treating.

★ ★ ★

**Other** editorials of the 8-page issue describe controlled atmosphere processes and new automatic dewpoint control systems.

★ ★ ★

**Write** for "Heat Treat Review," Vol. 6, No. 2, **Surface Combustion Corporation,** Toledo 1, Ohio.

### Steel Statistics Booklet

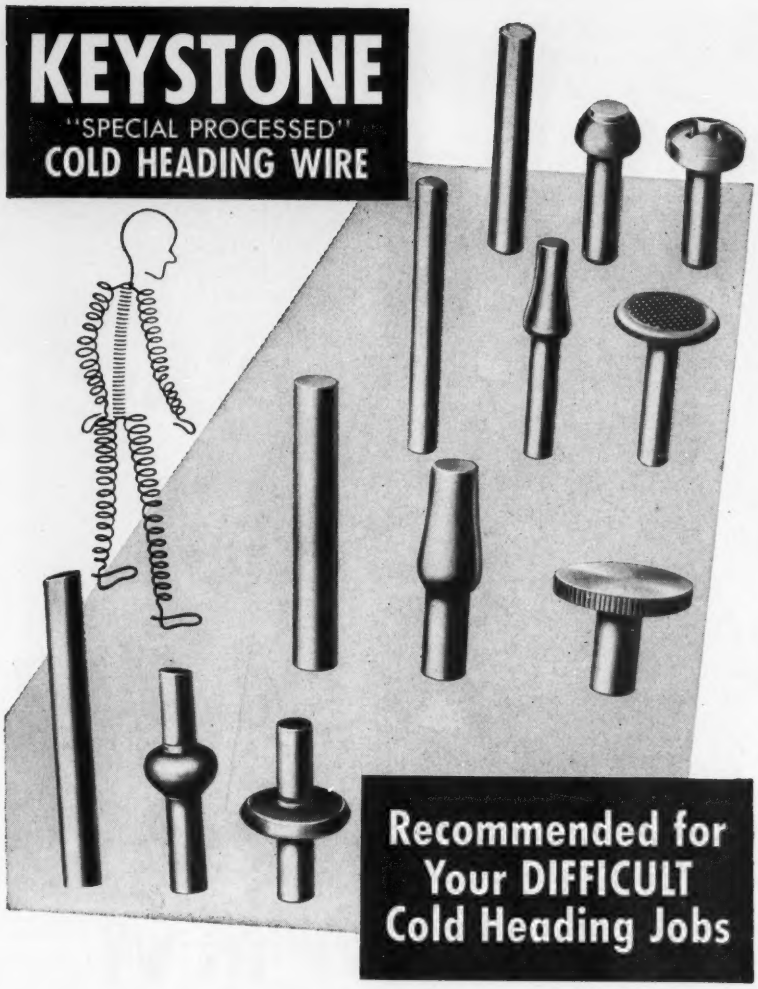
**The** 1955 edition of **"Charting Steel's Progress,"** a 72-page, illustrated booklet of pertinent iron and steel industry statistics, has just been published by **American Iron and Steel Institute.**

★ ★ ★

**The** pocket-size booklet presents important facts about one of the nation's most basic industries in graphic form. Each page of the booklet covers one significant phase of the industry's business and its service to its employees, stockholders, customers and the public. Numerous charts and graphs emphasize recent developments in the industry and illustrate the vital role of steel in the growth and progress of the nation.

★ ★ ★

**Among** the topics covered in the new edition of the steel industry

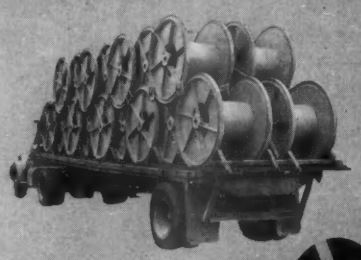

When you have "tough-to-make" cold heading jobs on your production schedule, it will pay you to consider the outstanding advantages offered by Keystone "Special Processed" Wire.

The superior grain flow characteristics of this wire provides the necessary upsetting and die forming qualities to withstand the terrific displacement of metal during the most difficult cold heading process. The structural soundness and uniformity of "Special Processed" Wire further proves itself through trouble-free machine operation, longer die life, and finished products of the highest quality.

If you have a special wire problem . . . large or small . . . let us help you solve it. Contact your Keystone representative or write.

There's no premium on INGENUITY at NYECO

Here are 32 Steel Shipping Reels being delivered on 1 especially rigged truck. One more example of the versatility and flexibility that go into every NYECO job . . . that make for happy customer relationships.



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NYECO Steel Shipping Reels

YOUR BEST BUY!

because they cost so little more, last *12 times* longer than wooden reels, require minimum maintenance. Rugged weatherproof, splinter-proof, warp-proof construction protects costly cable against damage due to dropping, bouncing, rough handling. It doesn't pay to risk an investment of thousands on inferior reels.

ANY QUANTITY | ANY SIZE | ANY LOAD | FLANGE DIAMETER FROM 36" UP

**SERVICE IS OUR BUSINESS:** Qualified engineering staff will translate your problems into practical designs, from idea to finished product—or we'll work from your blueprints. 2 large modern plants with every automatic production facility, 100 in skilled personnel. Fast deliveries—motor, rail, water shipping at the premises.

*For prompt, reliable, down-to-earth data and quotations*

WRITE, PHONE, WIRE

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TELEPHONE: WHitehall 4-5300 CABLE: NYECO, N. Y. PLANTS: YONKERS, N. Y.

*These leading mills prefer NYECO Steel Reels:* OKONITE, ROEBLING, WESTERN ELECTRIC, GENERAL CABLE, ANACONDA, PHELPS DODGE

facts book are (1) development of raw material reserves, (2) expansion of steelmaking capacity, (3) distribution of products, (4) wages, hours and working conditions, and (5) financial data.

★ ★ ★

**Single** copies of the booklet are available upon request to American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

## Titan Issues Booklet on Copper-Base Alloys

**The Titan Metal Manufacturing Company,** Bellefonte, Pa., has announced the issuance of a newly revised booklet entitled "Behind the Scenes." The booklet, beautifully illustrated, outlines in brief, a description of Titan processes of craftsmanship, service and control which feature all Titan products.

★ ★ ★

**Throughout** are shown some of the complex machinery required to make precision-perfect Titan brass, and controls to secure prime metal quality in the finished product. In the production of bronze welding alloys, the metals are melted and mixed and the pour is deoxidized twice to assure dependable qualities.

★ ★ ★

**The** company was a pioneer in the production of brass pressure die castings, and is today recognized as one of the largest producers of bronze welding rods.

★ ★ ★

**Copies** can be obtained by writing to the Manager, Customer Service Division.

## Carboloy Advances Prices

**Prices** on all grades of its carbides were increased an average of 10 per cent, effective Oct. 3rd, the **Carboloy Department of General Electric Company,** Detroit, has announced.

★ ★ ★

**The** increase covers cemented carbide for mining, woodworking, stone, metalworking and other tools, as well as dies.

## ABSTRACTS

PROBLEMS OF HIGH-SPEED WIRE-DRAWING FERROUS AND NON-FERROUS METALS

Anon. *Wire Ind* 1955 Vol 22 (259) pp 673-675, 677-678, 696 (July)

**Summary of points raised by discussion group at technical session of Joint Metall Soc mtg, Europe, 1955. British, US and continental machines, methods and lubrication problems. Copper wire drawing (Gt Britain): diamond dies for fine wire, but not for heavy rods. Die life in drawing copper wire considered poor, ie 0.001 in. dia wear on sintered carbide dies for 1,000 to 2,000 yd wire drawn. Better lubricant required. Machine with 2 fluids may have to be considered: one to cool, one to lubricate. Lubricants must volatilize completely at 200 to 300 deg C.**

★ ★ ★

RESEARCH ON THE DRAWING OF MILD STEEL TUBES. I

T. Akamoto. *Sumitomo Metals* 1953 Vol 5 pp 61-84 (Apr); abstr *Iron & Steel Inst Journ* 1955 Vol 180 (4) p 387 (Aug) (Original in Japanese)

★ ★ ★

POWDERED LUBRICANT

Glyco Prod Inc, NY. *Steel* 1955 Vol 137 (2) p 87 (July 11)

**Extremely tight-fitting metal-to-metal parts lubricated by Acrawax C Atomized lubricant, applied by dusting or dipping. Non-tacky, non-corrosive, insoluble in water, oil and solvents, mp 285 deg F (140 deg C).**

★ ★ ★

FUSSY MILL FOR FUSSY CUSTOMERS

Hamilton Watch Co, Lancaster, Pa. *Steel* 1955 Vol 137 (3) pp 128-129 (July 18)

**Miniature equipment within watch factory for melting forging, heat treating, rolling, slitting and wire drawing. Wire drawn from 0.003 to 0.187 in; own diamond dies made. 5 illustr.**

★ ★ ★

MECHANICAL MEANS OF PIERCING HOLES FOR ELECTRICAL INSTALLATIONS AND SUPPLY

E. V. Lukyanov, M. R. Naifeld. *Mekhan Stroit* 1955 Vol 12 (3) p 30; *DSIR Transl Cont Lists Russ Period* 1955 (76) p 60 (July) (In Russian)

★ ★ ★

THE SPEEDY DRAWING OF LOW CARBON STEEL WIRE

I. N. Nedovizy, A. L. Taravsky. *DSIR Transl Cont Lists Russ Period* 1955 (76) p 156 (July) (Original in Russian)

**Book, Metallurgizdat, Moscow, 1954, 188 pp. (Available in Sci Museum Library).**

★ ★ ★

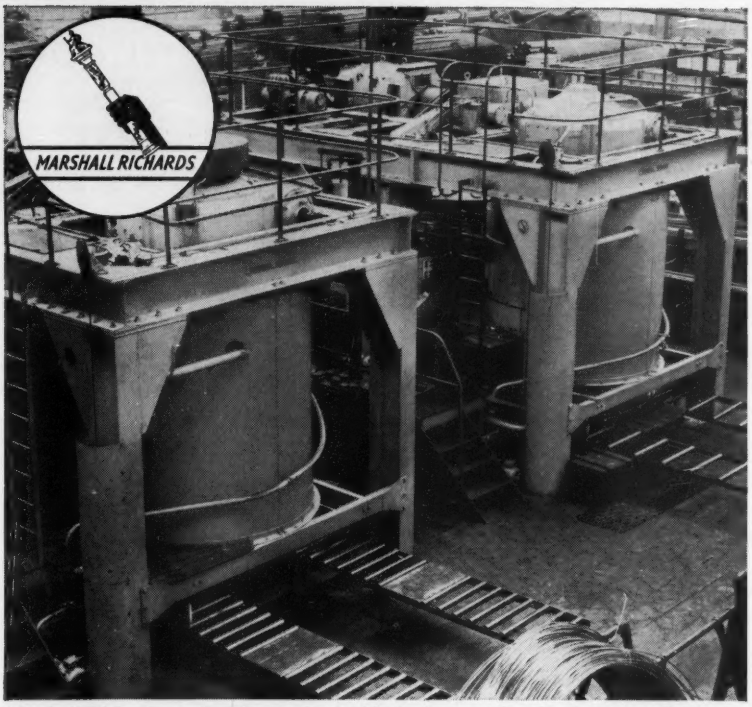
LUBRICANTS FOR WIREDRAWING

A. L. H. Perry (Shell Petroleum Co Ltd). *Sci Lubri* 1955 Vol 7 (5) pp 14-18 (May)

**Survey article. Lubricants for steel, copper, aluminium, and aluminium-alloy wires outlined. 5 illustr, 5 ref.**

★ ★ ★

MEASURING AND TESTING INSTRUMENTS (FROM REVIEW OF GERMAN INDUSTRIAL FAIR, HANOVER 1955).


Marshall-Richards vertical inverted tube blocks in operation for 2 years at Yorkshire Copper Works Ltd., Leeds, England. Typical drawing cycle, from 1.875″ o.d. and .094″ wall thickness to .322″ o.d. and .028″ wall thickness, in 8 passes. Drawing speeds from 225 to 2,025 fpm available.

# An Addition . . . That Multiplies Our Ability To Serve You

Fenn will now build and sell, on this side of the Atlantic, the outstanding wire and tube drawing machines of Marshall-Richards Machine Company, Ltd., of England.

You can now meet your every wire and tube fabricating need from one source, because these machines perfectly supplement Fenn's wire shaping mills, rolling mills, Turks Heads and swaging machines.

## The Fenn Manufacturing Company

**412 Fenn Road,**
**Newington, Connecticut**

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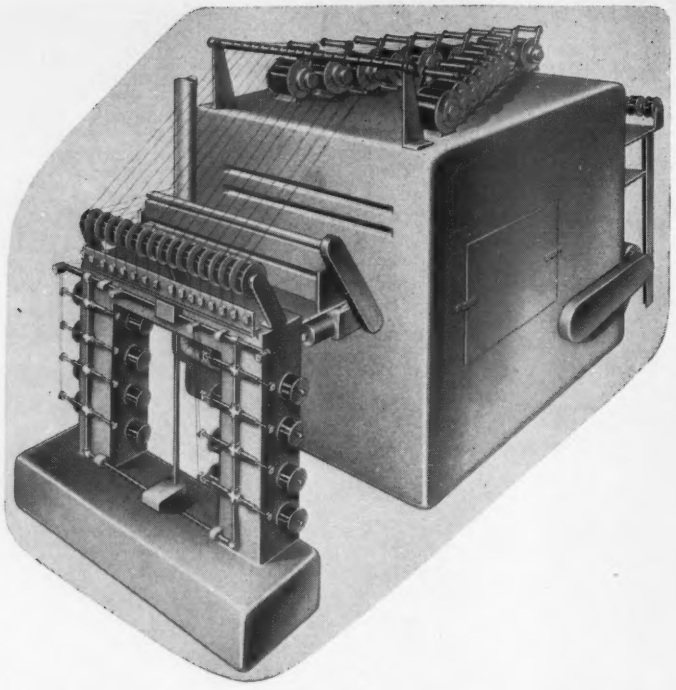
**Wire Shaping Mills**
**Precision Rolling Mills**
**Turks Heads**
**Swaging Machines**

FENN



# Increased Enameling Speed with Minimum Wire Breakage

By incorporating advanced design techniques with years of wire enameling research, this new MOCO fine wire enameling oven offers advanced enameling speeds with a marked decrease in breakage. The result is a cost-cutting operation with increased production.

The equipment is competitively priced and combines versatility with simplicity. The high degree of skill formerly required in performing this operation has been reduced—control of the product is handled by the machine.

## OTHER NEW FEATURES INCLUDE:

- Advanced design, offering low fuel consumption—less maintenance.
- A wide range of insulating materials may be handled.
- New rapid start-and-stop device increases production.

## FOR MORE DETAILS . . .

Write or phone for this informative brochure which tells the *complete* story of this new MOCO fine wire enameling equipment.

* * *

An experienced MOCO representative is near you—ready to aid in the solution of your wire enameling problems.

PRODUCERS OF COMPLETE ENAMELING SYSTEMS FOR ALL WIRE SIZES.

**MICHIGAN OVEN COMPANY**
**425 BRAINARD ST., DETROIT 1, MICHIGAN**

MESS- UND PRUEFGERAETE (TEIL DES AUFSATZES RUECKBLICK AUF DIE DEUTSCHE INDUSTRIE-MESSE HANOVER 1955)

K. Schroedter, P. Stoeckmann. *Werkstatt & Betrieb* 1955 Vol 88 (7) pp 350-357 (July) (In German)

**Section deals with new measuring instruments, in particular instruments for measuring angles of drawing dies by indirect method, fine wire roundness tester with projector, etc. 25 illustr.**

★ ★ ★

REDUCING REJECTS WHEN MANUFACTURING STEEL WIRE

I. I. Suprun. *Neuerschein wiss Lit* etc 1955 Vol 4 (9) p 475 (May) (Original in Czech)

**Book, Ust pro techn a ekonomické inf, Prague, 26 pp. 1954.**

★ ★ ★

PLANETARY IDLER CONE VARIES BACK TENSION IN WIRE DRAWING MACHINE

H. Suzuki (Inst Ind Sci, Tokyo Univ). *Design News* 1955 Vol 10 (12) pp 34-35 (June 15)

**By using adjustable cone between drawing cone and guide cone, ratio between back tension and wire drawing tension can be widely adjusted. Adjusting gear for changing back tension uses worm gear drive. 3 illustr.**

★ ★ ★

USP 2,686,369. WIRE DIE GAUGE. M. ONGERT

Abstr *Wire Prodn* 1955 Vol 4 (7) p 12 (June)

**Gauge has 2 crossheads, sliding and rigid, and pair of gauging members, one in shape of truncated cone. Die is placed between gauging members, which are suitably shaped to receive it, and reading taken.**

**These abstracts are published through the courtesy and with the permission of the Industrial Diamond Research Bureau, 34 Holborn Viaduct, London, E.C.1, England. Inquiries regarding them should be directed to the Bureau.**

## NEMA Standards

**The** following NEMA Standards Publication is available for immediate distribution:

**Asbestos, Asbestos - Varnished - cloth and Asbestos-thermoplastic Insulated Wires and Cables, WC 1-1955.**

★ ★ ★

**The** American Standards Association, Inc., Insulated Power Cable Engineers Association and National Electrical Manufacturers Association have published this book jointly. Detailed information is given concerning the construction, identification, insulation and testing of the following types of wires and cables: A, AA, AI, AIA, AVA, AVB, AVL and TA.

# Outstanding Personalities of the Wire Industry

### Cyclone Appoints Sales Executive

**The** appointment of **August L. Bartz** as assistant district sales manager of the Detroit area for the Cyclone Fence Department of **American Steel & Wire Division, United States Steel Corp.**, was announced recently by **E. Kyndberg**, general sales manager of Cyclone Fence.

★ ★ ★

**Mr.** Bartz came to Detroit as a salesman for Cyclone in 1946. He began his twenty years of service with U. S. Steel in 1935 when he was employed as a laborer at the Waukegan Works of American Steel & Wire Division. He has previously served in various positions in the press, shipping and accounting departments.

### A S & W Appointments

**A** series of three key appointments in the sales department of **American Steel & Wire Division** have been announced by **Harry M. Francis**, vice president of sales for this division of **United States Steel Corp.**

★ ★ ★

**Appointed** administrative assistant of sales is **Charles H. Schiller.** Succeeding Mr. Schiller as manager of commercial research is **Elliott D. Jones**, and appointed assistant manager of commercial research is **William P. Keefe.**

### Carboloy Adds Distributor

**Industrial Equipment Co.**, Joplin, Mo., was recently appointed an authorized Carboloy carbide tool distributor by **Carboloy Department of General Electric Company**, Detroit.

★ ★ ★

**The** organization will carry Carboloy's line of standard and special carbide metal cutting tools, as well as its masonry drills and diamond grinding wheel dressers.

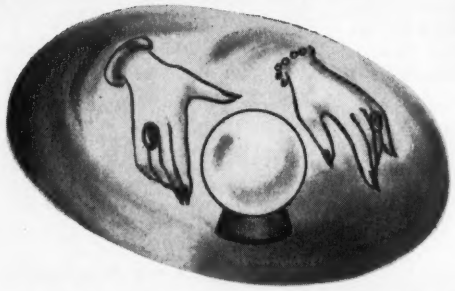
### Weiss Promoted by Keystone

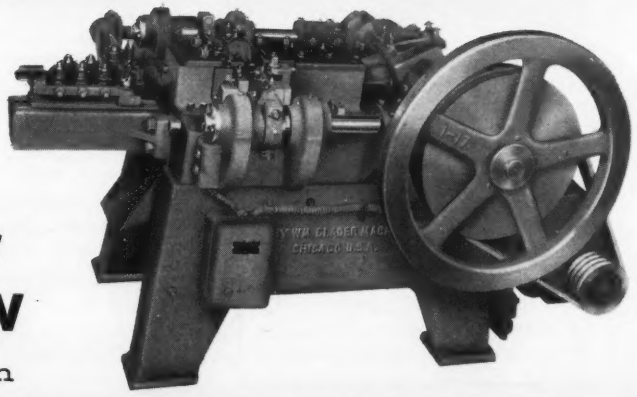
**Appointment** of **Jerry Weiss** to the position of Assistant Wire Mill Superintendent of **Keystone Steel & Wire Co.**, Peoria, Ill., effective July 1, has been announced by Management. In his new position he will assist in the supervision of overall Wire Mill operations. Mr. Weiss joined Keystone in November, 1927, as a tester in the Wire Mill Testing Department. In May, 1942, he was transferred to the Drawing Department as an assistant foreman and in December of the same year was appointed Superintendent of the Patenting Department. He is active in employee activities, is a former president and current member of the Executive Committee, Peoria Chapter of the American Society of Metals.

### Continental Can Announces Purchasing Realignment

**Continental Can Company** has announced a change in its head


IF THERE'S A NAIL MACHINE IN YOUR *Future* make it a GLADER





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EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

office Purchasing Organization which establishes **D. N. Rabishaw** as manager of purchases for Coatings and Chemical products and **J. J. Sherlock** as manager of purchases for Paper and Petroleum products. This realignment of functions among Continental's top Purchasing staff has become necessary by reason of the increased volume and variety of purchases in the several product divisions of the Company.

* * *

**J. J. Schneewind** continues as manager of Plate Purchases and **W. L. Dykema** remains in his capacity as manager of purchases for Equipment and Supplies. All purchasing managers report to **R. D. Weinland**, general manager of purchases.

### Appointed to Represent Hunter Spring in Michigan Area

**The Mezey Agency, Inc.,** 1135 Fisher Building, Detroit 2, Mich., has been appointed the exclusive representative of the **Hunter Spring Company** of Lansdale, Pa., for Michigan and adjoining sections of Indiana and Ohio. The agency will provide sales engineering services for all Hunter products. These products include the Neg'ator constant-force extension and motor spring and the Flex'ator constant-force compression spring, as well as precision springs and wire forms of all kinds, stampings, and wire and spring testing instruments. The agency has an experienced group of six trained principals specializing in the automotive, domestic appliance and related industries.

### Promoted by G. E.

**Wallace S. Frank** has been appointed Supervisor — Process Development Unit, for the **General Electric Company's Silicone Products Department,** according to an announcement by E. A. Kern, Manager — Engineering.

* * *

A native of Golconda, Illinois, Mr. Frank received his B. S. degree from the University of Illinois in 1944. Following wartime service with the United States Navy, he became a pilot plant engineer for the Firestone Tire and Rubber Company at Pottstown, Pa.

* * *

**He** joined General Electric as a chemical engineer at Waterford, N. Y., in 1950 and the following year became a group leader in the New Products and Processes section there. He was named to a supervisory post in 1953, and has served in various supervisory positions in engineering areas since that time.

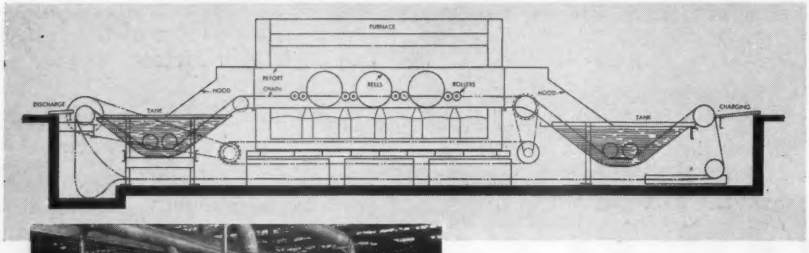
* * *

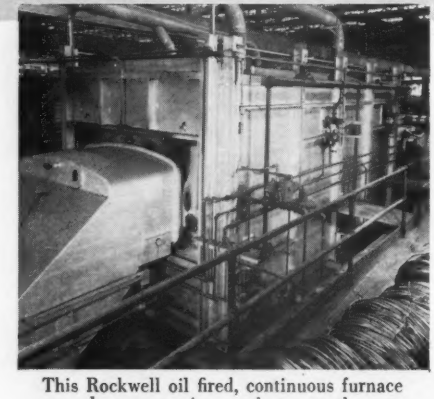
**Mr.** Frank's headquarters will be at No. 1 Mechanicville Road, Waterford, N. Y.

### Garfield Appoints West Coast Distributor

**Standard Wire & Cable Company,** of Los Angeles, has been appointed Sales Representative for Oregon, Washington, and California territory for the **Garfield Wire Division** of the **Overlakes Corporation,** according to an announcement made by **D. F. Mitchell,** Sales Manager of Garfield. Standard is located at 3440 Overland Avenue. So as to enable West


## *Bright Anneals Copper Wire at Lowest Cost*



This Rockwell oil fired, continuous furnace anneals copper wire on drums at the rate of 120,000 lbs. per 24 hrs. Drums travel 4 abreast. The work is carried through the exit hood, in foreground, into a steel water tank for quenching, without exposure.

The "wet" method of annealing copper wire (to be subsequently rubber covered), is a Rockwell development that has proved very efficient in operational simplicity, production quality, and labor and space saving.

Drums of coiled wire move continuously, from the wash or other process through a wet or dry seal, then through the alloy retort of the furnace, exit hood, water quench and discharge.

The reels or drums of wire travel several abreast, being rolled along the tanks and retort floor by pipe rollers attached to the alloy link chain conveyor. Length of processing system depends on production needs.

The furnace may be gas or oil fired, or electric. Annealing atmosphere may be provided to assure desired brightness of metal.

It will pay you to learn more about this and other types of Rockwell wire heating equipment. Get Bulletin 432.

**ROCKWELL ALSO BUILDS**

***Batch and continuous furnaces and ovens for annealing, aging, drying, enameling, tinning, glass coating, synthetic coating. Atmosphere generators.***

ROCKWELL SINCE 1888 BUILT

**W. S. ROCKWELL COMPANY**

FURNACES • OVENS • BURNERS • VALVES • SPECIAL MACHINERY

2425 ELIOT STREET • FAIRFIELD, CONN.

*Sales Representatives in Principal Cities*

Coast customers to receive speedy delivery for current urgent requirements, a local stock will be maintained.

* * *

**Garfield** Wire Division of Overlakes is primarily engaged in the manufacture of fine wires comprising fine magnet wires used for guided missiles, electronics and aviation industries. Additional products of Garfield include bare copper wire, tinned copper wire, bunched, stranded and concentric conductors. Manufacturing facilities of the corporation are located in Garfield, N. J.

* * *

**The** high precision type of manufacture typical of the guided missile and aircraft industries in Southern California make the manufacturing facilities of Garfield and their availability to West Coast customers of considerable import.

### Washington Representative Appointed Porter

**Paul Duncan** has been appointed Washington Representative for **H. K. Porter Company, Inc.** and its thirteen divisions. He comes to Porter with a wide background of experience in the nation's capital. Most recently he has been with Selvage & Lee, Washington public relations counsel, specializing in legislative and government relations.

* * *

**Mr.** Duncan's other Washington associations have been as Director of Information for the State Department's Point Four Program; Assistant to the Director of Price Stabilization; Administrative Assistant to Lister Hill, ex-Senator from Alabama; and Assistant to the Director of Economic Stabilization.

### Chemical Products Corporation Appoints Chicago Agents

**William I. McGowan,** President of **Chemical Products Corporation,** East Providence, R. I., has announced the appointment of **Gossett and Hill Company,** 7185 West Bloomingdale Avenue, Chicago 35, Ill., as agents for their Chem-o-sol (vinyl plastisols) and Nelco lacquers for plastic moldings in Illinois, Wisconsin, Indiana, and Metropolitan St. Louis. **Edward Moran** of Chemical Products Corporation will operate out of the Gossett and Hill offices as technical representative.

* * *

**Messrs.** Gossett and Hill are both graduate mechanical engineers with wide experience in plastic and rubber fields. Mr. Gossett, President, is President of the Chicago section of Society of Plastic Engineers and a graduate of Purdue University. Merton E. Hill is a graduate of Northwestern University.

* * *

**Mr.** Moran has spent the past two years in the Chemical Products Corporation's laboratories in East Providence, R. I.

* * *

**The** company's Chem-o-sols have found wide acceptance in the elec-


**MASON lightweight, non-returnable, lithographed spools for:**

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AUTOMOTIVE CABLE
THERMO-COUPLE WIRE
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IF you want dependable performance and attractive appearance—at a low, low cost—put Mason Spools at the top of your list!

Over 175 leading manufacturers can attest to the performance of Mason Spools. As for appearance... the rich, colorful perfection of Mason lithography is your best assurance of *instant brand identification.*

Mason Spools are available in 5", 6½", 8½", and 10½" head sizes. All sizes available with 1⅞" (Dia.) barrels. The 10½" head size is available with a 3½" (Dia.) barrel. Barrel lengths from ⅜" to 14".

**Let us know about your spool requirements now! Telephone East Providence 1-2810 or write to the address below.**

**MASON CAN COMPANY**
**1949 Dexter Road, E. Providence 14, R. I.**
**Branch Plant — Greenville, Ohio**

troplating rack, tank, electrical appliances, cloth, and yarn coating fields. They may be dipped, sprayed, knifecoated, or molded.

### L.O.F Glass Fibers Appoints Boston Representative

**Chester E. Shepperly** has been named District Manager of the Boston Area for the **L. O. F Glass Fibers Company** according to an announcement by **J. M. Johns,** Vice President and Director of Sales of the company. He will headquarter at a new office, 701 Washington Street, Newtonville 60, Massachusetts, in the company's Eastern Regional Sales area reporting to **Thomas L. Carver,** Regional Sales Manager.

★ ★ ★

**Previously,** he had been Boston District Manager for the Fiber Glass Division of Libbey-Owens-Ford Glass Company. It was this division which merged first with the L-O-F Corrulux Division and later with Glass Fibers Inc., to form the new L.O.F Glass Fibers. Before this, Mr. Shepperly had been an industrial field representative for Libbey-Owens-Ford for six years.

### Bethlehem Promotes Bolton

**Announcement** has been made of the promotion of **W. J. Bolton** to Assistant General Superintendent of the Los Angeles plant of the **Bethlehem Pacific Coast Steel Corp.,** a division of the **Bethlehem Steel Company.**

### Appoints Two Regional Sales Managers

**Thomas L. Carver** has been appointed Sales Manager of the Eastern Region for the **L. O. F Glass Fibers Company,** and **John B. Banks** has been appointed to a similar post in the Central Region, **J. M. Johns,** Vice President and Director of Sales, has announced.

★ ★ ★

**Mr.** Carver will headquarter at 441 Lexington Avenue, New York and Mr. Banks will have offices at 18263 Hartwell, Detroit.

**Prior** to his appointment, Mr. Carver has been the New York District Manager for the Fiber Glass Division of Libbey-Owens-Ford, and Mr. Banks was Philadelphia Regional Sales Manager.

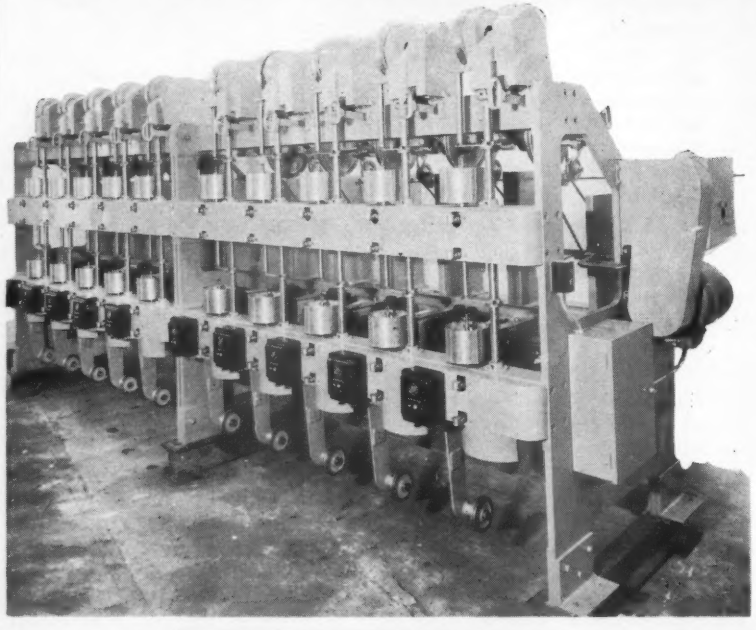
### To Head Chattanooga Control of CIA

**Charlton W. Smith,** comptroller, **Southern Electrical Corp.,** Chattanooga, Tenn., has been elected president of the Chattanooga Control of the **Controllers Institute of America.**

★ ★ ★

**The** following have been named directors of Institute local Controls in their respective areas: **Jay T. Sarles,** comptroller, **Rome Cable Corporation,** Rome, N. Y.; **Douglas T. Dixon,** comptroller and assistant general manager, **George W. Prentiss & Company,** Holyoke, Mass.; **James S. Howard,** treasurer, **Johnson Steel & Wire Co., Inc.,** Worcester, Mass.; **Norman F. Jefferson,** treasurer and comptroller, **The B. Greening Wire Co., Ltd.,** Hamilton, Ont.; and **Clarence**


**2D-10-MBB INSULATION WINDING MACHINE No. 1129**



APPLIES DOUBLE COVER TO 10 LINES OF WIRE SIMULTANEOUSLY. NOMINAL WIRE RANGE #15 TO #25 B&S GAUGE (.057" TO .018" or 1.450MM TO .455MM). STANDARD CAPSTANS 8" DIAMETER. SUPPLY WIRE LETOFFS AND TAKE-UPS ARE AT REAR OF MACHINE NOT SHOWN. MACHINE CAN BE ARRANGED SPECIAL WITH 12" DIAMETER CAPSTANS FOR HEAVIER WIRES.

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PHILADELPHIA 33 PENNSYLVANIA U.S.A.

**W. Snyder,** controller and assistant secretary, **John A. Roebling's Sons Corp.,** Trenton, N. J.

★ ★ ★

**Established** in 1931, the Institute is a non-profit management organization of controllers and finance officers from all lines of business.

### Ferrari Joins Alloy Metal Wire

**Fred Ferrari** was recently appointed to the staff of Alloy Metal Wire Division, H. K. Porter Co., Prospect Park, Pa., in the metallurgy department as assistant to **Ray Warner,** Chief Metallurgist.

★ ★ ★

**Mr.** Ferrari is a graduate of Drexel Institute of Philadelphia with a Bachelor of Science degree in Metallurgy. Under Drexel's cooperative program he worked several summers at the Alloy plant in both the metallurgy and inspection departments. His duties will include research and development work on new materials and processing techniques, and metallurgical quality control of wire, rod and strip production.

### Staples Retires From Bristol Brass

**Horace W. Staples,** chief metallurgist of the **Bristol Brass Corporation,** retired in September after serving in the brass industry for 44 years.

★ ★ ★

**Although** retired, Mr. Staples will serve Bristol Brass as a consultant in metallurgy and will continue in his post as secretary of the Bristol Brass Foundation.

★ ★ ★

**Born** in Westport, Conn., he was graduated from Yale University's Sheffield Scientific School in 1907. In 1910 he joined Bridgeport Brass as a junior chemist and metallurgist and he first started to work for Bristol Brass on October 1, 1916.

### Appoints Research Director

**Dr. Robert M. Brick,** former director of the school of metallurgical engineering at the University of Pennsylvania, has been named director of the department of metallurgy of **Continental Can Company's** Central Research and Engineering Division.

★ ★ ★

**His** industrial experience included employment by the Aluminum Company of America, Bethlehem Steel and consulting work for numerous metal producers, fabricators and users.

★ ★ ★

**His** academic career has included membership on the faculty of Yale University. He also is the author of a widely-used college textbook on metallurgy and over 30 scientific papers.

### John B. Pottinger, Jr.

**John B. Pottinger, Jr.,** 53, assistant superintendent of control and copper production at the **Westinghouse Electric Corporation,** Buffalo, N. Y., died September 19th. He was employed by Westinghouse in East Pittsburgh before coming to the Buffalo plant seven years ago.


CAMDEN WIRE CO., INC.

*Wire Fabricators*

**Producers of Quality Fine Wire Copper Conductors**

**EXTRA FLEXIBLE CONDUCTOR STRANDED OR BRAIDED**

**MULTIPLE ENDS OF SIZES .008 to .002**

**BARE · TIN or LEAD COATED · SILVER PLATED**

**Special Heavy Tinned Conductors for Hook-up Wire**

**40 MASONIC AVENUE** • **CAMDEN, NEW YORK**

### Wylie L. Graham

**Services** were held here for Wylie L. Graham, production superintendent of the **American Steel & Wire Company**, New Haven, Conn., died September 16th at his home in East Haven. He was 61 years of age.

★ ★ ★

**Mr.** Graham had been associated with the American Steel & Wire Division of U. S. Steel since 1934 and held the position of superintendent since 1940. He had previously held a position in the aerial tramway department.

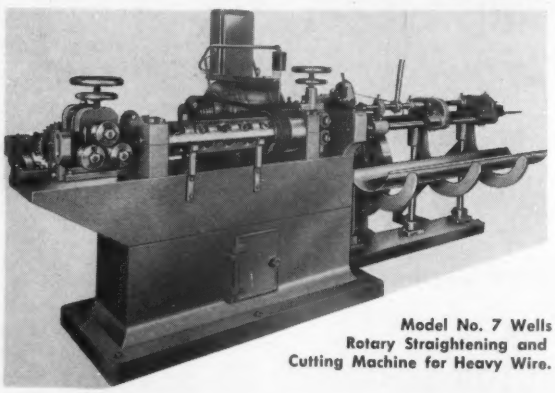
### James G. Daugherty

**James G. Daugherty,** superintendent of **Pittsburgh Screw & Bolt Corporation** plant on Neville Island, Pa., died on September 8th. He was 51. He had been associated with the company for more than 37 years, having joined the firm when he was only 14 years old.


*A Fast, Dependable Wells*

**STRAIGHTENER AND CUTTER FOR HEAVY WIRE**

Shown below is the famous Model No. 7 WELLS ROTARY STRAIGHTENING AND CUTTING MACHINE designed for a maximum of durability and service.



Model No. 7 Wells Rotary Straightening and Cutting Machine for Heavy Wire.

Flyer runs in ball bearings. All wear parts made of tough steel for long, trouble-free operation.

Motor and gears are readily accessible through door in base.

A highly satisfactory machine for day-in, day-out production.

This machine is designed to handle 1/4", 5/16", 3/8", 7/16" and 1/2" wire at speeds of 90' to 100' on long continuous production runs. Other WELLS MACHINES are made to handle smaller gauges of wire at correspondingly higher speeds.

*Backed by 59 years of experience and development*

Send for Catalog covering the full line.

*Frank L. Wells Company*

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***Builders of Fine Wire Working Machinery***


### Harry J. Miller

**Harry J. Miller,** former vice president, secretary and a director of the **Pittsburgh Steel Company,** died at Pittsburgh on September, 1, 1955. He was 72.

★ ★ ★

**Mr.** Miller had a long career in the steel industry before he retired in 1948. After being graduated from Cornell University in 1907 he worked for three years in the rolling mill department of the Duquesne, Pa., works of what then was Carnegie Steel Company. He joined Pittsburgh Steel Company in 1910 and advanced to executive posts as the company grew. He also was active in nearly a dozen other concerns, serving as an executive officer of many of them.

### Irving T. Bennett

**Irving Theodore Bennett,** chairman of the board of **General Cable Corporation** died on October 3rd. Mr. Bennett was born in Bridgeport, Conn., on July 30, 1900.

★ ★ ★

**Mr.** Bennett was elected chairman of the executive committee and a director of General Cable Corporation May 1, 1953 and, in April 1954, was elected chairman of the board of directors of the corporation and chief executive officer.

★ ★ ★

**Between** 1929 and 1953 Mr. Bennett had been an official of **Revere Copper & Brass, Inc.** From 1944 until 1953 he was a vice president of Revere with headquarters in Baltimore. He became a director in 1951. Until becoming an official of General Cable he had been general manufacturing manager in charge of all Revere production operations.

★ ★ ★

**During** World War II he was a member of the Aluminum Advisory Committee of the U. S. Government Munitions Board.

★ ★ ★

**He** was a director of Metal Textile Corporation, Roselle, N. J. and Metal Textile Corporation of Canada, Ltd., Toronto, and also a vice chairman and director of Telecables & Wires, Ltd., Winnipeg.

# A Review of Recent Wire Patents

**The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.**

**Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.**

No. 2,717,111, SIPHON TUBE BASKET, patented September 6, 1955 by William D. Gilardi, Dos Palos, Calif.

The basket is constructed mainly of wire and rod material.

★ ★ ★

No. 2,717,221, METAL WORKING METHOD, patented September 6, 1955 by Robert M. Christner, Beaver Falls, Pa.

In the process of drawing stainless steel the inventor provides the steps which comprise coating the steel with a slurry formed of water and the reaction product of ferrous sulphate and lime in water in substantially stoichiometric amounts, drying the slurry on the stainless steel to form a coating thereover and during which drying the iron compound present is oxidized by contact with air.

★ ★ ★

No. 2,717,285, CAPSTANS FOR ADVANCING STRANDS, patented September 6, 1955 by Vincent A. Rayburn, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

For advancing a number of wires the inventor has disclosed a capstan including a rotatable cylindrical member having axial splines thereon, driving discs splined on the cylindrical member, metal rings having strand-engaging outer peripheries, and annular insulating members, with the cylindrical member having means for compressing the driving discs, the annular insulating members, and the rings against each other to establish a friction driving connection between the rings and the rotatable cylindrical member.

★ ★ ★

No. 2,717,301, DEVICE FOR SOLDERING PIN, SOCKET AND THE LIKE TO THE END OF WIRE AND THE LIKE, patented September 6, 1955 by Henry Johnson Dixon, West Kirby, Joseph Edward Geoffrey Chapman, Workington, and Frederick Arthur Harwood, Maghull, near Liverpool, England, assignors to British Insulated Callender's Cables Limited, London, England, a British company.

This is an automatic machine for carrying out a cycle of operations as indicated and including a heater for the pin so that it may be thermally attached to the conductor wire and then cooled.

★ ★ ★

No. 2,717,485, WIRE LAYING MACHINE, patented September 13, 1955 by Thomas H. Pearce, Niles, Mich., assignor to National-Standard Company, Niles, Mich., a corporation of Michigan.

A rotor unit for a wire laying machine is disclosed and comprises a frame having a bore therein, a generally tubular rotor journaled in the bore in the frame, a pair of cradle means journaled in the rotor and including portions projecting to opposite sides of the rotor and the frame, and means for restraining movement of each of the cradle means with respect to the frame.

★ ★ ★

No. 2,717,650, WIRE CENTRALIZERS FOR WELL CEMENTING, patented September 13, 1955 by Jesse E. Hall, Sr., Weatherford, Tex.

The device is adapted to be mounted on the exterior of a well casing and is constructed partly of stout wire.

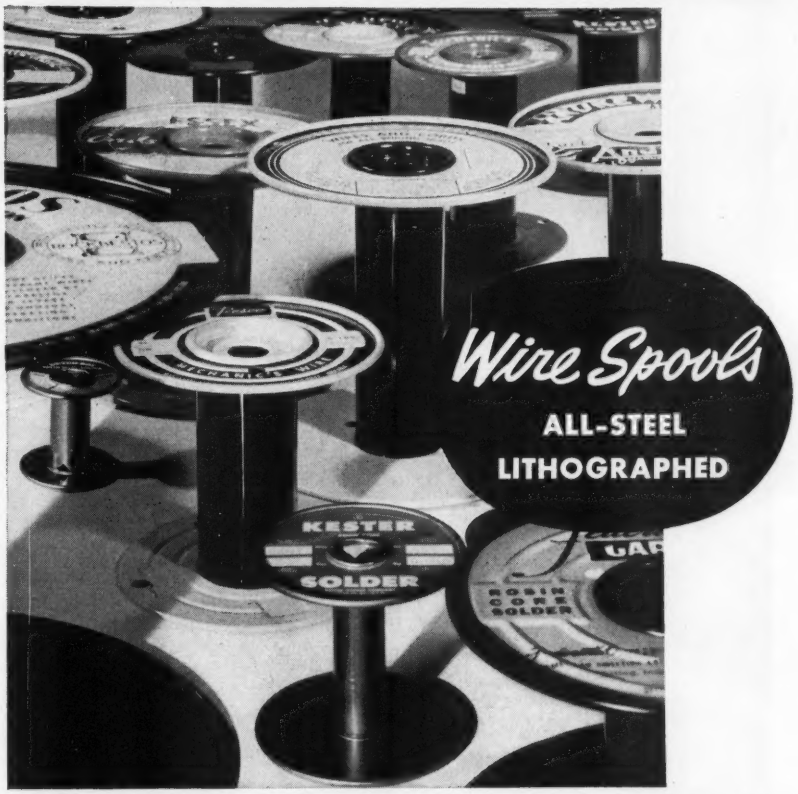
★ ★ ★

No. 2,717,743, CLUTCH MECHANISM FOR COILING DEVICES, patented September 13, 1955 by Hugh C. Eames, Oxford, Conn., assignor to Farrel-Birmingham Company, Incorporated, Ansonia, Conn., a corporation of Connecticut.

The mechanism is associated with apparatus for coiling rod and the like. There are fifteen claims.

★ ★ ★

No. 2,717,776, APPARATUS FOR HEAT-TREATING WIRES, patented September 13, 1955 by Vincent A. Rayburn, Baltimore, Md., assignor to West-


Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.
5″ and 6-1/2″ diameter ends with 1-15/16″ diameter traverses.
10-1/2″ diameter ends with 3-1/2″ diameter traverses.
Traverse lengths up to 12″

J. L. Clark
LITHOGRAPHED METAL CONTAINERS

J. L. CLARK MANUFACTURING COMPANY • ROCKFORD, ILL.

ern Electric Company, Incorporated, New York, N. Y., a corporation of New York.

A segmental muffle is provided for maintaining a substantially oxygen-free atmosphere through which a number of spaced parallel wires are advanced during a heat treatment thereof.

★ ★ ★

No. 2,718,315, STACKER MECHANISM FOR COIL SPRINGS, patented September 20, 1955 by Martin J. Nelson, Chicago, and Thaddeus S. Cetnar, Lombard, Ill., assignors to Wunderlich Spring Machinery Company, a corporation of Illinois.

The springs are forwardly rotated in a foolproof manner, as is stated in the specification, as they are advanced through the stacker to present the same knots forwardly, into the stack of springs. There are nineteen claims.

★ ★ ★

No. 2,718,359, ARMATURE WINDING MACHINE, patented September 20, 1955 by William P. Hunsdorf, Cleveland, Ohio, assignor, by mesne assignments, to Cleveland Electrical Equipment Co., Inc., Cleveland, Ohio, a corporation of Ohio.

More specifically, there is provided apparatus designed to releasably grip one end of an armature for alternate reciprocation and part-turn rotation in a winding mechanism. There are eighteen claims.

★ ★ ★

No. 2,718,494, METALLIC COATING FOR WIRE, patented September 20, 1955 by Charles L. Faust, Columbus, Ohio, assignor to the United States of America as represented by the Secretary of the Army.

★ ★ ★

The method of co-electrodepositing a lead and antimony alloy coating directly upon copper wire of which the coating contains about 12% by weight of antimony and 88% by weight of lead, comprises immersing the wire in an electrolytic bath consisting of an aqueous solution of about 7.5 grams per liter of basic lead acetate, 18 grams per liter of sodium hydroxide, 3.5 grams per liter of sodium hydroxide tartrate, 19 grams per liter of potassium antimonyl tartrate, and 12 grams per liter of potassium tartrate, passing an electric current through the bath in such a manner so that the copper wire to be plated is made the cathode, regulating the electric current to provide a current density of about 10 amperes per square foot and heating the bath to a temperature of about 75° F. to 85° F.

★ ★ ★

No. 2,718,544, JACKETED MULTIPLE CONDUCTOR CABLE, patented September 20, 1955 by Robert O. Shepp, Fairfield, Conn., assignor to General Electric Company, a corporation of New York.

An electric cable is disclosed comprising a number of insulated conductors having a non-adherent surface stranded together in side by side relation to provide a compact core at the surface of which are longitudinally extending interstices between adjacent conductors triangular in cross-section, an open mesh woven covering of glass yarns applied directly on the core whereby the yarns are in direct contact with the insulated conductors except over the interstices, and an outer insulating sheath over the woven glass yarn covering which sheath extends through the openings between the glass yarns and fills the triangular-shaped longitudinally extending interstices and adheres to the glass yarns, whereby the outer sheath is only lightly bonded to the insulation of the conductors to make the stripping of the outer sheath from the cable relatively easy.

★ ★ ★

No. 2,718,647, METHOD OF MAKING COPPER COATED NAIL FROM COPPER COATED ROD STOCK, patented September 27, 1955 by Charles Greif Raible, Chesterland, Ohio, assignor to Fanner Metal Products Company, Cleveland, Ohio, a corporation of Ohio.

The method is disclosed of fabrication of a rigid driving headed fastening nail out of a length of stock having a core of rigid ferrous metal that is embedded in a coating of non-corrosive copper metal of appreciable thickness.

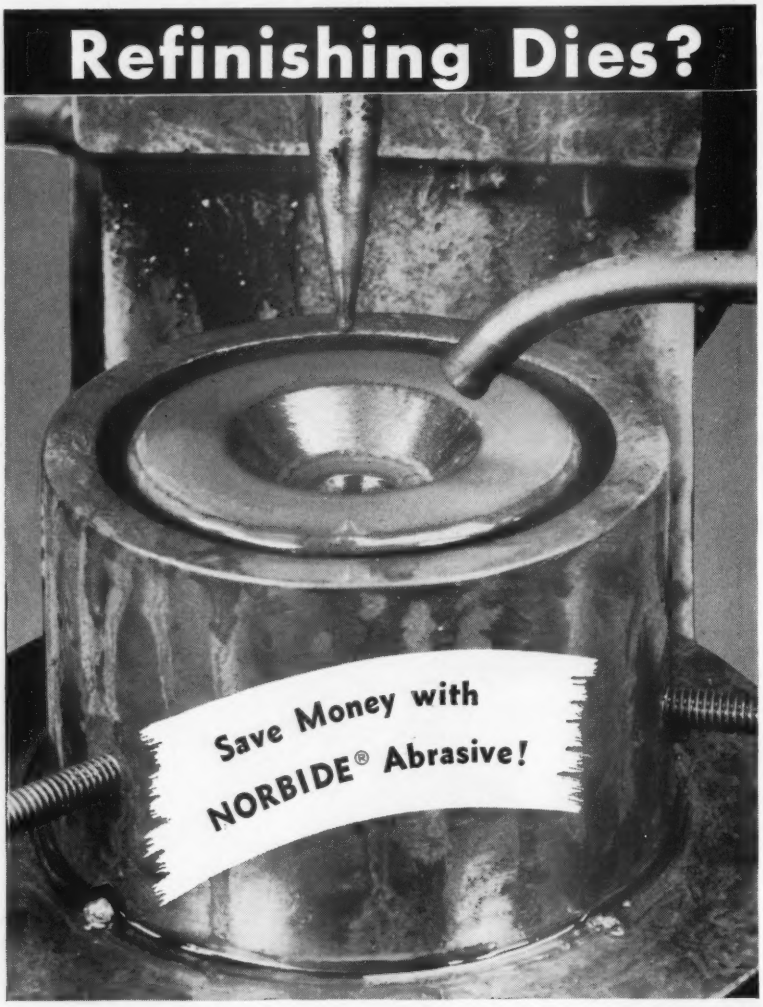
★ ★ ★

No. 2,718,659, APPARATUS AND PROCESS FOR RECOILING COILS, patented September 27, 1955 by Carl H. Judisch, Hamden, Conn., assignor to Whitney Blake Company, New Haven, Conn., a corporation of Connecticut.

An apparatus is claimed, in eight claims, for simultaneously unwinding and reversing the pitch of an elongated resilient coil wound in a helix upon a mandrel.

★ ★ ★

No. 2,718,660, APPARATUS FOR RECOILING COILS, patented September 27, 1955 by Samuel Sherwood Day, New Haven, Conn., assignor to Whitney


You may never use a wire drawing die this large, but no matter what size dies you're refinishing, you can save money by using NORBIDE Abrasive — rather than costly diamond dust — for ripping or fast stock removal as well as for accurate semi-finishing operations. For details, write for Form 559.

NORTON
BORON CARBIDE

NORTON COMPANY
New Bond Street
Worcester 6, Mass.

Blake Company, New Haven, Conn., a corporation of Connecticut.

Herein is disclosed an apparatus for simultaneously unwinding and reversing the pitch of an elongated resilient body wound in a helix upon an arbor.

★ ★ ★

No. 2,718,914, METHOD AND MEANS FOR THE EXECUTION OF COIL SPRINGS, FILAMENTS FOR INCANDESCENT BULBS AND THE LIKE HELICALLY WOUND PARTS, patented September 27, 1955 by Jean Nagel, Paris, France.

The method of helically coiling a wire about an elongated mandrel, with the wire having at least one longitudinal plane of symmetry, comprises guiding the wire to the mandrel along a path oblique to the longitudinal axis of the mandrel and continuously and uniformly bending the wire about the mandrel by frictionally gripping the wire at a number of points forming diametrically opposed parallel lines of contact between the mandrel and a rotatable member, and rotating the rotatable member so that its wire contacting surfaces travel in a frustoconical path about the mandrel.

★ ★ ★

No. 2,719,012, STRAND-ADVANCING APPARATUS, patented September 27, 1955 by Estyle D. Hanson, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

More specifically, the apparatus is for advancing means for taking up wire conductors of indefinite lengths on reels.

★ ★ ★

No. 2,718,314, STACKER MECHANISM FOR COIL SPRINGS, patented September 20, 1955 by Martin J. Nelson, Chicago, and Clifford E. Ives, Wilmette, Ill., assignors to Wunderlich Spring Machinery Company, a corporation of Illinois.

There are sixteen claims to this patent to an adjustable stacker which, it is stated, nests the springs in uniform stacks, and advances the stacked coils into and along a stacking channel.

## To Wind Association Clock

**It** is traditional that the 400-day grandfather clock, presented to The Wire Association in 1948 by its British members, be wound each year by a visitor from England around Annual Convention time.

★ ★ ★

**This** year **Reginald S. Bleckley,** Director and General Manager of **Rylands Brothers Ltd.,** Warrington, England, has accepted an invitation to wind the clock. He is in this country to attend the Convention in Chicago and will come to Stamford toward the end of November before returning to England.

## Braider Bobbin of Nylon Permits Accurate Put-Up

**Wire** braider bobbins molded of "Zytel" nylon resin are solving a long-time problem for wire braiders. Unlike metal spools the resilient nylon bobbin head will return to its original form after bending. Since the bobbins are injection molded, they are absolutely uniform in size. Because of this uniformity and the fact that the heads do not bend permanently out of shape, accurate put-up is now possible at all times.

★ ★ ★

**Bobbins** of "Zytel" break very rarely (less than one per cent per year in test installations) and operating economy is said to be greatly increased, in contrast to the problems caused by bent heads on metal bobbins.

★ ★ ★

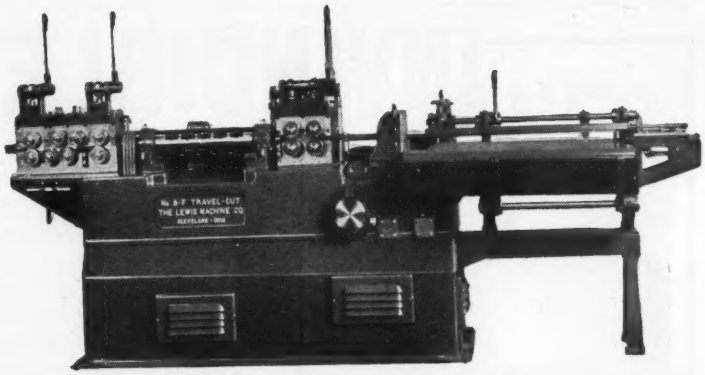
**Bobbins** of this material are manufactured by **Plastic Mold and Engineering Company,** Providence, R. I.


*Fast, Accurate, Economical*

**STRAIGHTENING and CUTTING**

*with* LEWIS **TRAVEL-CUT**

**(Trademark)**



**23 Models to handle from .012" to ¾" Round, Hex, Flat, Shapes.**

**Simple in design, rigid in construction, Lewis TRAVEL-CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL-CUT. Full details on request.**

***Exclusive Representatives***

**EAST:** Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

**MIDDLE WEST:** Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

**CENTRAL:** Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

**WEST COAST:** Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California.

**CANADIAN:** Empire Engineering Co., 738 Dundas St., East, Toronto, Ont., Canada.

**CONTINENTAL EUROPE:** Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

**The LEWIS MACHINE Company**

**3441 E. 76th Street, Cleveland 27, Ohio**

***Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne***

### General Cable to Build Plant in Florida

**General** Cable will construct a modern manufacturing plant in Tampa, Fla., where it already operates a warehouse and sales office, it was announced by **I. T. Bennett,** chairman of the board and **J. R. MacDonald,** president of General Cable.

★ ★ ★

**The** initial unit will have approximately 50,000 square feet and will be equipped with completely modern equipment for the manufacture of paper telephone cable and other wires and cables for the constantly growing requirements of the rapidly expanding telephone companies operating in the Southeast.

★ ★ ★

**Although** the initial unit will be equipped primarily for the manufacture of telephone wires and cables, the company has bought sufficient land to enable it to construct additional units for the manufacture of wires and cables for the utility, industrial and building markets.

★ ★ ★

**Construction** of the new General Cable plant started in October and it is expected to be in operation by March, 1956. It will be a modern one-story building with a brick front and an air-conditioned office. Approximately 125 people will be employed at the start.

★ ★ ★

**Upon** the completion of the Tampa plant, General Cable will be operating nine plants in the United States. The other plants are located at Bayonne and Perth Amboy, N. J.; Emeryville and Los Angeles, Calif.; Monticello, Ill.; Providence, R. I.; Rome, N. Y. and St. Louis, Mo. It is also constructing a plant in Winnipeg, Canada in association with Canadian and British interests.

### Standard Screw Gauge and Round Stock Calibrator

**A** new improved combination standard screw gauge and round stock calibrator is offered free to production heads in metal working industries.

★ ★ ★

**This** gauge will calibrate immediately all sizes of both machine and wood screws from #0 through #14. It also has a calibrated scale by 32nds for calibrating all kinds and makes of round stock, and sixty-fourths can be easily estimated.

★ ★ ★

**This** gives a definite assurance in establishing all wood and machine screw sizes by their standard gauge size.

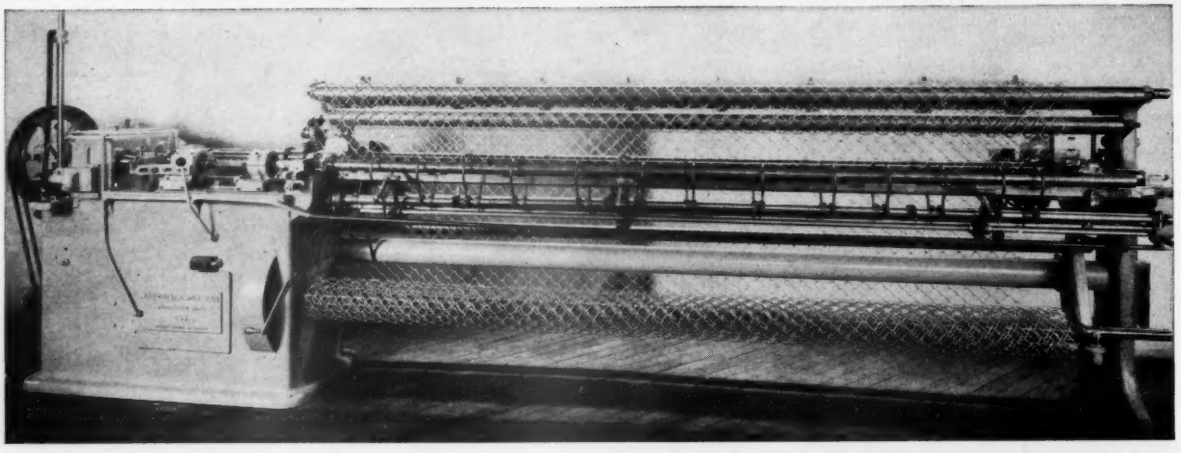
★ ★ ★

**Requests** for this gauge should be made on company letterhead to **Dayton Rogers Manufacturing Co.,** 2824-13th Avenue South, Minneapolis 7, Minn.

### Power Cable Insulation Resists Acids, Alkalis

**After** eleven years' exposure to highly corrosive conditions in chemical plants, power cable insulated with Bakelite polyethylene still maintains 100 per cent circuit


**INVINCIBLE CHAIN-LINK FENCE MACHINE**



**The INVINCIBLE feeds the two wires to its Giraffe and Blade by a New Method. High Tension with consequent Heavy Wear in the Driving Gears, Clutches, Giraffe & Blade is eliminated and a lot of power saved.**

**The New Applicator provides a Reversed Bend directly onto the Blade and insures a Flat Sided Spiral. It is a Wire Saver too. The fence rolls weigh several pounds less each. Its Giraffes wear less and are Reversible. They have at least three times as long life.**

**ARTHUR BLASHILL & COMPANY**
**Temporary Office 78 DOWNING STREET**
**WORCESTER 10, MASSACHUSETTS, U.S.A.**

availability. Construction savings of 15 to 25 per cent have been realized by the use of polyethylene-insulated cable for more than 500,000 feet of power cable installed at chemical plants in South Charleston, W. Va. Power cable insulated and jacketed with Bakelite polyethylene has resisted the corrosive attack of chlorine gas, moisture and sodium chloride in underground ducts since 1944 without electrical or mechanical failure. The excellent electrical characteristics of Bakelite polyethylene are combined with flexibility, toughness and resistance to most chemicals. With a jacket made of Bakelite vinyl resins over the polyethylene insulation, power cable designed for 600, 5,000 and 15,000-volt class construction has delivered trouble-free service for seven years so far. Tapes made of Bakelite polyethylene and vinyl resins are used to splice these cables. Under highly corrosive conditions electrical conduit coated with Bakelite polyethylene remains almost unaffected long after bare galvanized metal is eaten away with holes. Active chemical spilled in the vicinity of a power cable jacketed with synthetic rubber and insulated with natural rubber shows serious deterioration. When insulation of similar cable was dissolved by chemical spillage at a Texas City, Tex. plant, causing a three-phase fault, it was replaced by polyethylene-insulated cable. After three and one-half years of continuous service, the polyethylene insulation gives no indication of damage even though some of the chemical was still present when it was installed.

### Develops New Impregnating Varnish

A new type of silicone impregnating varnish—possessing greatly improved physical properties at temperatures up to 250° C—has been announced as available by **General Electric Company's Silicone Products Department.**

★ ★ ★

**The** new resin is said to represent a significant advance in silicone varnish technology. It has been long recognized that silicone varnishes for the electrical industry were more than adequate in terms of electrical properties, but not in physical properties.

★ ★ ★

**GE** approached the problem by improving such physical properties as bonding strength and overall toughness. The resin will cure at 150° as rapidly as other silicone varnishes cure at 250° C. Its low viscosity provides good penetration into electrical equipment and shows much less weight loss than conventional varnishes when tested at 250° C.

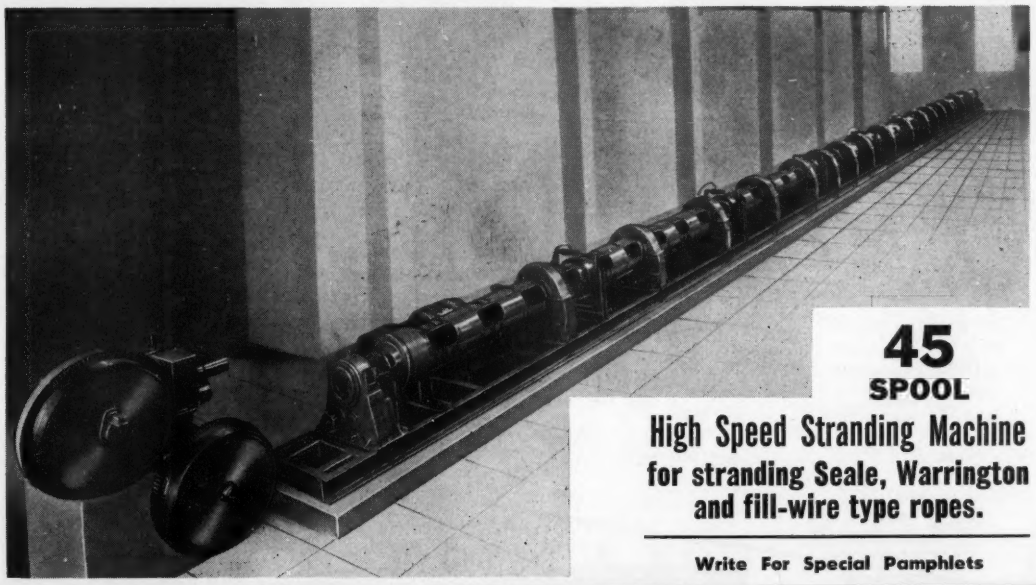
★ ★ ★

**Designated** SR-60 silicone varnish, the resin has been developed in the department's laboratories for impregnating and bonding electrical equipment such as stator and armature coils, aircraft generators, dry-type transformers, and glass asbestos served wire.

★ ★ ★

**Technical** information on SR-


NIEHAUS WIRE STRANDING ROPE CLOSING CABLE MAKING MACHINES



45 SPOOL

High Speed Stranding Machine for stranding Seale, Warrington and fill-wire type ropes.

Write For Special Pamphlets

MASCHINENFABRIK K. A. NIEHAUS • GERMANY

DÜSSELDORF-RATH

60 silicone impregnating varnish may be obtained by writing the Silicone Products Department, General Electric Company, Waterford, N. Y.

### Guides for Cap Screw Selection Outlined by R B & W

**Because** assembly cost often counts more than the purchase price of the fastener, designers and purchasing agents should look to the assembled cost in selecting fasteners, states the **Russell, Burdsall & Ward** Bolt & Nut Co., Port Chester, N. Y., fastener specialists.

★ ★ ★

**In** selecting cap screws, for example, compare heat-treated and bright finish types on the basis of physical properties. The color is indicative of their physical properties. Bright screws get their shiny appearance from cold working. For many applications, bright screws, with their close tolerances, accurate threads and excellent appearance, are ideal.

★ ★ ★

**Black** cap screws, with three radial dashes on the head, get their color, strength and ductility from their high-carbon content and from heat treatment. They afford greater toughness for jobs where high stresses will be encountered.

★ ★ ★

**Heat-treated** screws can stay tighter than bright ones. Holding power of a fastener depends upon tensile strength. High-carbon heat-treated cap screws, because of this, are capable of being stressed much higher. If a joint is loosening, often the cure can be found in a black heat-treated cap screw tightened to set up the correct residual tension.

★ ★ ★

**Though** initial cost of heat-treated cap screws is greater than the bright finished type, they can often cost less if holding power is the important quality needed For example, to obtain a safe working load of 20,000 pounds, you can use a 3/4-inch bright cap screw or a 5/8-inch black cap screw. The smaller screw, heat-treated, costs less than the larger bright one.

★ ★ ★

**Correct** use of cap screws in designing new equipment often permits reduction in size and number of fasteners and holes, thus saving production time and increasing the strength of the assembly.

### Booklet on Cable Joint Making

**Complete,** step-by-step pictorial directions for making all types of cable joints in **Anaconda Wire & Cable Company's** neoprene-jacketed Durasheath cables are contained in a pocket-size booklet released by the Cable Accessories Department.

★ ★ ★

**Prepared** for use by both engineers and cable splicers, the booklet tells its story in nine clear photographs supplemented by simple 1-2-3 written instructions. Complicated engineering drawings and tables are eliminated. Write for a copy to Anaconda Wire & Cable Co., 25 Broadway, New York, N.Y.

The Difference
IS HERE.....
NEW MPS CONVOLUTE DURA CURL RIMS...
The difference between just any spool or reel and Superior MPS CONVOLUTE DURA CURL Rims is well worth your close attention. Because now, with this exclusive MPS feature, maximum strength and rigidity are obtained throughout the reel heads. You can now have continuous trouble free high speed winding, without spool straightening expense. These new MPS spools also have the famous No-Crev feature.
Ask about MPS CONVOLUTE DURA CURL RIMS today. We invite your inquiries.
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Telephone Attleboro 1-0848
Mossberg PRESSED STEEL Corporation
MPS
CONVOLUTE
Dura Curl
Spools & Reels
give you brute strength with dimensional precision, concentricity, and balance. Another patented MPS development engineered to help you!
#110

### Folder on Plating Equipment

**Universal Industrial Equipment Co.,** Secaucus, N. J., has issued a folder on plating equipment for wire, wire products and other materials. These include batch and continuous types, washing machines, storage tanks, etc.

★ ★ ★

**Materials** of construction are stainless steel and other metals, as required. Designs are said to be advanced and techniques assure strength, premanence and economy.

★ ★ ★

**Besides** standard lines, equipment will be custom made to fit customers' requirements. You are invited to send for a copy of this bulletin.

### Carboloy to Handle Development Work on Synthetic Diamonds

**Responsibility** for commercial development of the process for manufacturing man-made diamonds, recently announced by the General Electric Research Laboratory, has been assigned to the company's **Carboloy Department,** Detroit, **K. R. Beardslee,** general manager, has revealed.

★ ★ ★

**According** to Mr. Beardslee, his department will in the next few years, bridge the gap between the laboratory and the production line in an effort to make these diamonds available to American industry.

★ ★ ★

**Future** commercialization of these industrial diamonds, he indicated, would give U. S. industry an independent, domestic source for this strategic material.

### Hollow Wire Staples and Rings from Holland

**Several** new metal products have been added to the list of manufactures of the **Jean Guppertz Knopen en Metaalwarenfabriek Inc.,** Zaltbommel, Holland, manufacturer of metal products in the Netherlands.

★ ★ ★

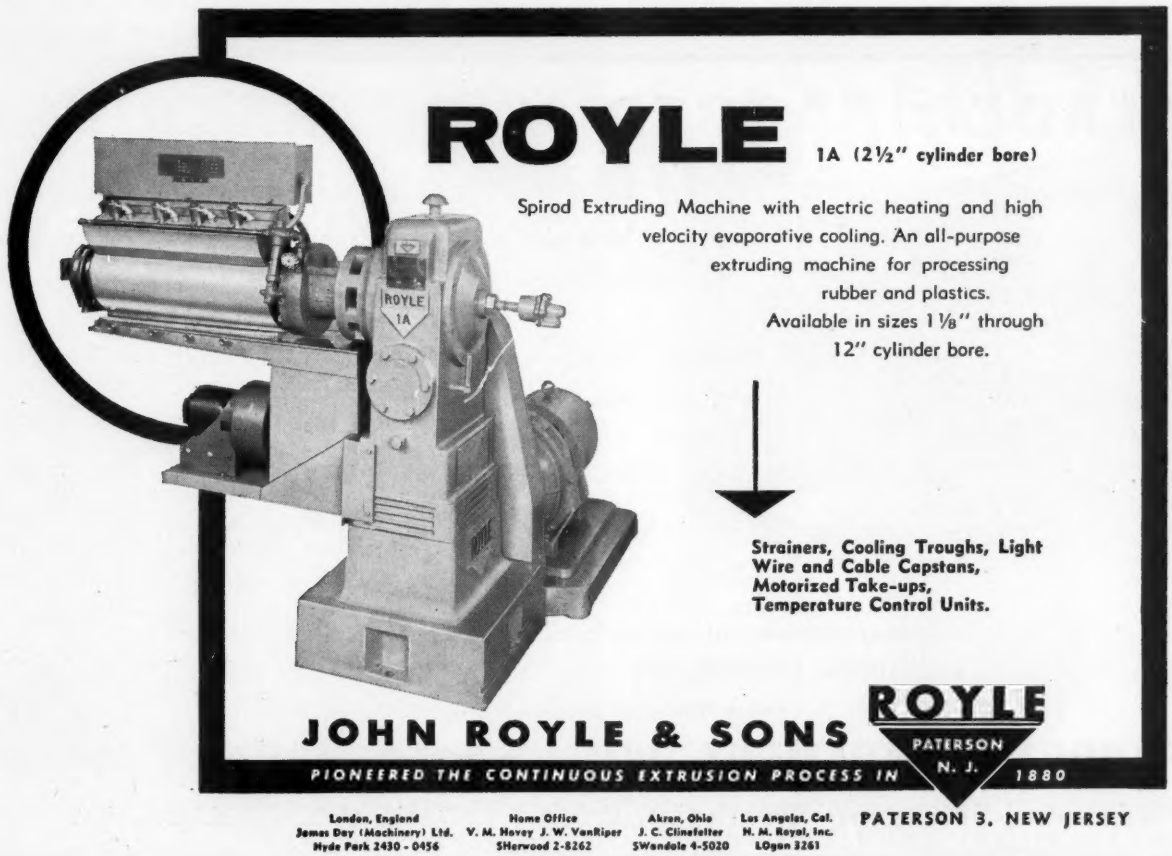
**The** products are: double and automatic hollow wire staples, blind rings and shoe rings, corset rings, belt rings and label rings.

★ ★ ★

**The** new products are presently available for export from the Netherlands.

### The Turks Head in Shaped Wire Production

**Traces** the development of this little-understood machine which is capable of drawing an almost endless variety of rectangular, square and special shapes from rod or wire. Explains basic rules of operation and application to be followed for best results. Uses several case studies to promote better understanding of machine's capabilities. (8 pages) **The Fenn Manufacturing Company,** Fenn Road, Newington, Connecticut.

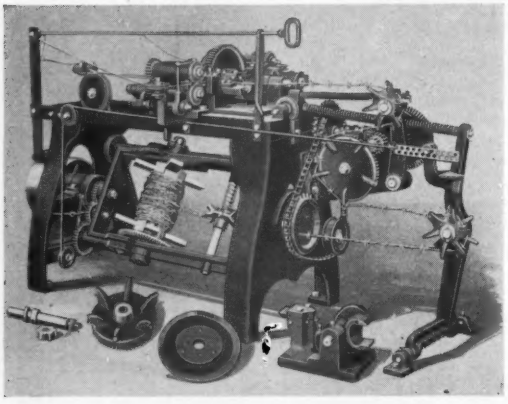


ROYLE
1A (2½" cylinder bore)
Spirod Extruding Machine with electric heating and high velocity evaporative cooling. An all-purpose extruding machine for processing rubber and plastics.
Available in sizes 1⅛" through 12" cylinder bore.
Strainers, Cooling Troughs, Light Wire and Cable Capstans, Motorized Take-ups, Temperature Control Units.
ROYLE
1A
JOHN ROYLE & SONS
ROYLE
PATERSON
N. J.
1880
PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN
London, England
James Day (Machinery) Ltd.
Hyde Park 2430 - 0456
Home Office
V. M. Hovey J. W. VanRiper
SHerwood 2-8262
Akron, Ohio
J. C. Clinefelter
SWandale 4-5020
Los Angeles, Cal.
H. M. Royal, Inc.
LOgan 3261
PATERSON 3, NEW JERSEY

| ALUMINUM STATISTICS (in pounds) Collected by The Aluminum Association for August 1955 | August 1955 | July 1955 | August 1954 | 1st 8 Months 1955 | 1st 8 Months 1954 |
|---|---|---|---|---|---|
| PRIMARY PRODUCTION | 267,101,817 | 265,337,163 | 250,592,575 | 2,052,171,990 | 1,933,714,005 |
| SHIPMENTS OF ALUMINUM PRODUCTS | | | | | |
| SHEET and PLATE.....Total | 130,104,460 | 106,992,864 * | 91,330,525 | 920,981,548 | 660,641,020 |
| Non Heat-treatable | 107,123,187 | 87,826,712 * | 71,358,270 | 734,422,409 | 507,752,714 |
| Heat-treatable | 22,981,273 | 19,166,152 | 19,972,255 | 186,559,139 | 152,888,306 |
| FOIL (including foil in lamination, aluminum content only) | 17,926,890 | 15,364,556 | 14,028,863 | 132,049,548 | 93,572,687 |
| EXTRUDED PRODUCTS.....Total | 35,619,453 | 34,695,652 | 24,128,680 * | 268,151,819 | 178,334,305 * |
| Alloys 1100-3003-5052-6061-6062-6063 | 31,846,173 | 31,503,604 | 19,727,403 * | 239,557,853 | 134,823,501 * |
| All other alloys | 3,773,280 | 3,192,048 | 4,401,277 | 28,593,966 | 43,510,804 |
| TUBE, Drawn.....Total | 4,838,170 | 5,485,091 | 3,571,689 | 53,868,511 | 40,977,587 |
| Alloys 1100-3003-5052-6061-6062-6063 | 4,189,108 | 4,846,969 | 3,020,521 | 49,425,444 | 35,269,602 |
| All other alloys | 649,062 | 638,122 | 551,168 | 4,443,067 | 5,707,985 |
| BAR and ROD, Rolled (3/8" and over, maximum diameter across flats) | 14,276,056 | 15,648,245 | 12,913,086 | 118,336,820 | 93,384,393 |
| WIRE other than Conductor | 4,322,976 | 3,944,097 | 3,722,034 | 31,304,155 | 23,670,318 |
| ACSR and CABLE, Bare | 12,057,710 | 9,229,422 | 9,081,415 | 82,830,972 | 78,491,286 |
| FORGINGS | 3,344,640 | 2,706,511 | 3,292,703 | 30,432,523 | 30,028,417 |
| Total number of companies included | 44 | 44 * | 42 * | | |

October 5, 1955 * Revised from previous reports. ≠ No longer includes die casting shipments.

## Aluminum Statistics


# GLADER BARBED WIRE MACHINES



USED THROUGHOUT THE WORLD . . . for producing barb wire of any style or type of 2-point or 4-point wire, made from round wire.

GLADER COMBINATION BARB WIRE MACHINE . . . makes 2-point and 4-point barb wire.

GLADER BARB WIRE MACHINES also makes 2-strand plain cable wire, without barbs.

★ ★ ★ ★ ★

Also manufacturers of the world-renowned GLADER WIRE NAIL MACHINES, producing wire nails from 1/4" brads to 12" spikes.

*Write for Bulletin No. 32*

## EXPORT DEPARTMENT, WM. GLADER MACHINE WORKS

122 EAST 42nd STREET, NEW YORK 17, N. Y., U. S. A. CABLE ADD: "SEBOLDEX—NEW YORK"

## AMERICAN IRON AND STEEL INSTITUTE

350 FIFTH AVENUE, NEW YORK 1, N. Y

AIS 10

Total Number of Companies Included 134

AUGUST - 1955
Month

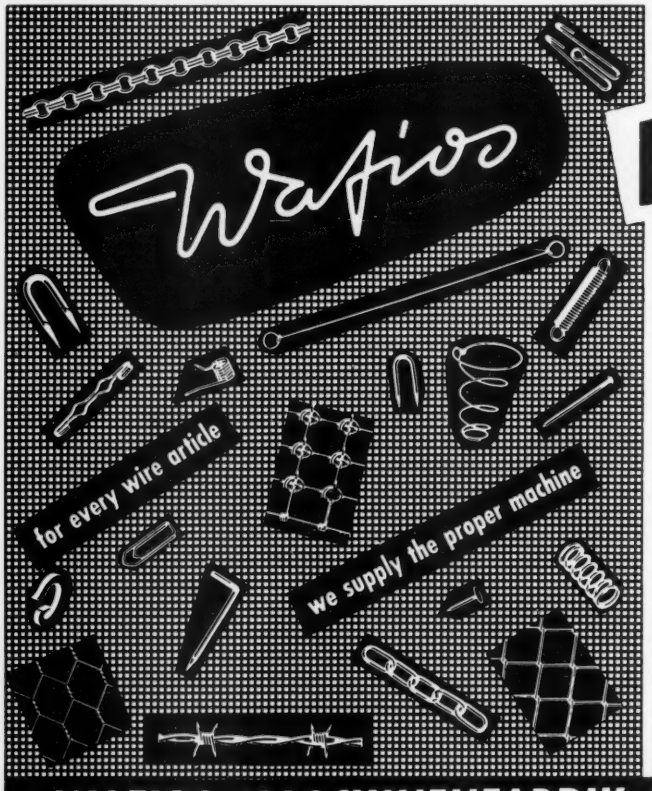
### SHIPMENTS OF STEEL PRODUCTS
### ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

| Steel Products | Items | CURRENT MONTH 1955 Carbon | Alloy | Stainless | Total | Percent of Total Shipments | Prior Year (1954) Percent of Total Shipments | YEAR TO DATE 1955 Carbon | Alloy | Stainless | Total | Percent of Total Shipments | Prior Year (1954) Percent of Total Shipments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingots | 1A | 34,706 | 13,348 | 1,920 | 49,974 | 0.7 | 0.5 | 249,256 | 111,198 | 17,661 | 378,115 | 0.7 | 0.5 |
| Blooms, slabs, billets, tube rounds, sheet bars, etc. | 1B | 181,476 | 49,482 | 1,966 | 232,924 | 3.3 | 2.6 | 1,484,072 | 356,831 | 12,422 | 1,853,325 | 3.3 | 2.3 |
| Skelp | 2 | 15,888 | - | - | 15,888 | 0.2 | 0.2 | 114,776 | - | - | 114,776 | 0.2 | 0.2 |
| Wire rods | 3 | 97,194 | 2,024 | 523 | 99,741 | 1.4 | 1.4 | 737,076 | 15,153 | 5,562 | 757,791 | 1.4 | 1.2 |
| Total Semi-Finished | | 329,264 | 64,854 | 4,409 | 398,527 | 5.6 | 4.7 | 2,585,180 | 483,182 | 35,645 | 3,104,007 | 5.6 | 4.2 |
| Total Rails and Accessories | | 154,908 | 95 | - | 155,003 | 2.2 | 2.3 | 1,474,213 | 933 | - | 1,475,146 | 2.7 | 3.5 |
| Bars—Hot rolled (incl. light shapes) | 14 | 534,225 | 178,586 | 3,921 | 716,732 | 10.2 | 9.5 | 4,225,122 | 1,399,609 | 28,695 | 5,653,426 | 10.2 | 9.6 |
| Bars—Reinforcing | 15 | 197,373 | - | - | 197,373 | 2.8 | 3.3 | 1,388,150 | - | - | 1,388,150 | 2.5 | 2.8 |
| Bars—Cold finished | 16 | 127,679 | 25,991 | 4,613 | 158,283 | 2.2 | 1.9 | 983,658 | 190,166 | 34,682 | 1,208,506 | 2.2 | 1.8 |
| Tool steel | 17 | 1,100 | 7,894 | - | 8,994 | 0.1 | 0.1 | 9,915 | *63,709 | - | *73,624 | 0.2 | 0.1 |
| Total Bars and Tool Steel | | 860,377 | 212,471 | 8,534 | 1,081,382 | 15.3 | 14.8 | 6,606,845 | *1,653,484 | 63,377 | *8,323,706 | 15.1 | 14.3 |
| Standard pipe | 18 | 264,372 | -4 | - | 264,368 | 3.7 | 4.5 | 1,940,765 | 478 | 2 | 1,941,245 | 3.5 | 3.6 |
| Oil country goods | 19 | 170,205 | 32,729 | - | 202,934 | 2.9 | 4.4 | 1,361,006 | 273,653 | - | 1,634,659 | 3.0 | 3.8 |
| Line pipe | 20 | 315,132 | 30 | - | 315,162 | 4.5 | 4.9 | 1,986,165 | 30 | - | 1,986,195 | 3.6 | 4.6 |
| Mechanical tubing | 21 | 54,385 | 24,200 | 383 | 78,968 | 1.1 | 1.0 | 453,355 | 160,787 | 3,269 | 617,411 | 1.1 | 1.0 |
| Pressure tubing | 22 | 20,284 | 2,245 | 1,097 | 23,626 | 0.3 | 0.5 | 147,777 | 17,903 | 9,620 | 175,300 | 0.3 | 0.5 |
| Wire—Drawn | 23 | 261,868 | 3,561 | 2,593 | 268,022 | 3.8 | 4.2 | 2,025,779 | 29,806 | 20,630 | 2,076,215 | 3.8 | 3.7 |
| Wire—Nails & staples | 24 | 55,892 | - | - | 55,892 | 0.8 | 1.1 | 464,912 | - | 1 | 464,913 | 0.8 | 0.9 |
| Wire—Barbed & twisted | 25 | 5,898 | - | - | 5,898 | 0.1 | 0.2 | 96,813 | - | - | 96,813 | 0.2 | 0.3 |
| Wire—Woven wire fence | 26 | 20,109 | - | - | 20,109 | 0.3 | 0.5 | 247,675 | - | 1 | 247,676 | 0.4 | 0.5 |
| Wire—Bale ties | 27 | 5,121 | - | - | 5,121 | - | 0.1 | 49,975 | - | - | 49,975 | 0.1 | 0.1 |
| Total Wire & Wire Products | | 348,888 | 3,561 | 2,593 | 355,042 | 5.0 | 6.1 | 2,885,154 | 29,806 | 20,632 | 2,935,592 | 5.3 | 5.5 |
| Strip—Hot rolled | 37 | 157,946 | 3,402 | 450 | 161,798 | 2.3 | 2.3 | 1,351,804 | 19,759 | 3,404 | 1,374,967 | 2.5 | 2.2 |
| Strip—Cold rolled | 38 | 115,380 | 1,350 | 20,636 | 137,366 | 2.0 | 2.0 | 920,629 | 9,341 | 173,876 | 1,103,846 | 2.0 | 1.9 |
| Total Sheets and Strip | | 2,470,761 | 98,646 | 36,966 | 2,606,373 | 37.0 | 32.7 | 20,003,998 | 724,045 | 293,732 | 21,021,775 | 38.0 | 32.7 |
| Total Shipments (1955) | | 6,527,112 | 470,344 | 56,159 | 7,053,615 | 100.0 | xxx | 51,302,404 | *3,550,466 | 441,486 | *55,294,356 | 100.0 | xxx |
| Total — Prior Year (1954) | | 4,383,288 | 261,977 | 35,977 | 4,681,242 | xxx | 100.0 | 39,758,500 | 2,401,190 | 286,261 | 42,445,951 | xxx | 100.0 |

*Revised.

## Steel Statistics

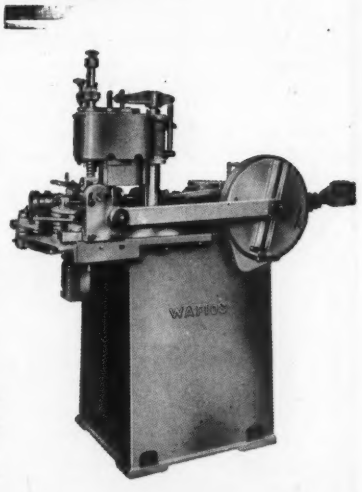

AUTOMATICS

FOR THE WIRE TRADE

AUTOMATIC TORSION SPRING COILING MACHINE

Model SFM, 4 different sizes

Wire Range: .008—.315"

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Kurt Orban Co., Inc.
34 Exchange Place,
Jersey City 2, N. J.

WAFIOS MASCHINENFABRIK REUTLINGEN 3 / GERMANY

# WHAT HAPPENS TO LOOSE ENDS?

Some people believe in tying up the loose ends. We believe there's an easier way of eliminating them.

Loose, frayed ends on glass-braided wire that has been stripped and tinned are a real problem. They look messy. They get in the way. And the increased diameter of the wire defeats the engineer's efforts to make room for the greatest possible number of wires.

Our laboratory's contribution to the solution of this problem was to develop a NELCO saturant that does a slick job of controlling and keeping flat those frayed ends of glass braid. This is the saturant's primary job but it has some other very fine qualities.

First of all, it operates as a barrier coat between the primary insulation and subsequent lacquering. This results in much higher insulation resistance.

Secondly, it resists discoloration due to ultra-violet exposure.

Thirdly and importantly, this NELCO saturant in no way adds any flammability to the finished wire.

And finally, the saturant is easily applied either in a lacquering tower or during the braiding operation.

Instead of worrying, wondering what to do about those loose, frayed ends on your glass-braided wire, turn the problem over to us and we'll show you how to make every strand lie down in its proper place.

**Chemical Products**
CORPORATION
King Philip Rd., East Providence, R. I.


## HCl Absorbers

**Camac** Karbate falling film HCL absorbers designed for laboratory and pilot plant applications are now available in capacities of 15, 30 and 45 lbs. per hour of HCL gas. Matching scrubbing towers and piping connections supplied if required.

★ ★ ★

**Heads** are made of Furacam plastic, falling film cooling tube is of Karbate and cooling water jacket is steel. A special packing arrangement is employed to allow easy tube replacement and cleaning. Design provides for delivery of cool stable acid up to 22° BE. concentration.

★ ★ ★

**Complete** data and standard prices are available from the manufacturer, **Carl Buck & Associates,** Essex Fells, N. J.

## New Warehouse for Macwhyte

**Macwhyte Company,** wire rope manufacturers, have moved into new quarters at 188 King Street, San Francisco. A complete new building with facilities for handling, cutting, and shipping wire rope has been built.

★ ★ ★

**Formerly** located at 141 King Street, this Pacific Coast office and warehouse serves all classes of trade in a wide area. Other West Coast warehouses and company offices are located at Los Angeles, Portland, and Seattle.

## Western Electric Turns to Aluminum

**Spiraling** copper prices and repeated shortages in the supply of the metal have caused the **Western Electric Company,** one of the largest users of copper, to move ahead with a definite engineering development program looking toward the substitution of aluminum for copper in its manufacture of telephone cable. The Company furnishes cable and wire to Bell Telephone Companies throughout the country.

★ ★ ★

**Initially** facilities are being set

*Handwriting of a man about to discover*

the secret of cutting, forming, and grinding metals at top rates . . . with fewer rejects and longer tool, die, and abrasive life. You too will benefit from the modern compounds developed by specialists with 23 years of engineering and manufacturing experience. What's more, you'll like the friendly, cooperative approach that Bick engineers take in solving lubricant problems. To get the most out of your machines, always call Hans C. Bick to smooth and cool the way.

Hans C. Bick, INC
READING, PENNSYLVANIA

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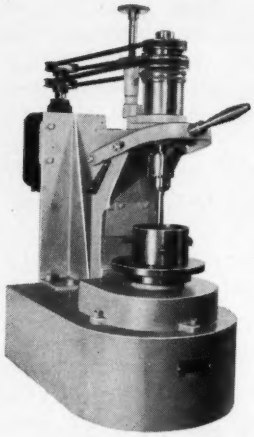
**DYKREX**
"IT CORRECTS THE DIE"

## Medium Duty Lapping or Ripping Machine



*At* **NEW LOW PRICE**

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up to develop suitable processes for quantity production of aluminum conductors for certain sizes of telephone cables. This program will be stepped up by converting more facilities now used for drawing copper wire to the extent dictated by future overall economic and supply considerations.

★ ★ ★

As part of its exploratory work in the last three years, Western Electric has produced several billion conductor feet of cable in which aluminum was substituted for copper. In use this cable has performed satisfactorily and experience gained in the trial installations provided answers to splicing and other problems related to the substitution.

★ ★ ★

**Besides** relieving the Company's dependence upon one metal, its program of substituting aluminum for copper will result in material savings based upon present prices of the two metals. Copper presently is selling at 258 per cent above levels prevailing in January 1946. The rise in the price of aluminum in this same period has been only about 63 per cent. Furthermore, aluminum prices have been subject to less violent fluctuations.

### Connors Steel Buys Sutton Straightener

**Connors Steel Division** of **H. K. Porter Company, Inc.** has awarded a contract to **Sutton Engineering Company** for a Sutton 2FX Straightener.

★ ★ ★

**The** new machine will be used at The Connors Birmingham, Alabama plant to straighten and polish cold drawn round bars of from ¾" to 4½" diameter for material for the automotive industry. It will be part of the first high speed straight production line installation of its kind in the southern states.

★ ★ ★

**The** Sutton FX line of straighteners employ five rolls, four of which are driven to provide a burnishing action which polishes the bars as they are straightened at high production speeds up to 240 feet per minute.


BETTER WORKING CONDITIONS

FASTER BUTT WELDING

FASTER ACID NEUTRALIZING

LONGER STORAGE SAFETY

YOU GET THEM ALL WITH

**BORAX 5 MOL.**

RUST INHIBITOR COATING

LONGER DIE LIFE

**...and ONE DIP is all that is necessary for coating steel rods**

BORAX 5 MOL offers worthwhile advantages over regular borax as a satisfactory coating material on ferrous rods and wire in preparation for dry drawing. This newer material offers a higher concentration of sodium borate and therefore savings may be realized through reduced transportation, handling, and storage costs. Only about three-fourths as much Borax 5 Mol need be used to equal regular borax... yet you get the same worthwhile results!

*WRITE FOR YOUR COPY OF NEW SERVICE BULLETIN*

**PACIFIC COAST BORAX CO.**
DIVISION OF BORAX CONSOLIDATED, LIMITED
NEW YORK • CHICAGO
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MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

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*If you require a Vinyl compound rated higher than 105 degrees C for special applications, we suggest you communicate with us, as we may have a compound to meet your requirements.*

Your inquiries are invited.

**ELECTRONIC RUBBER COMPANY**

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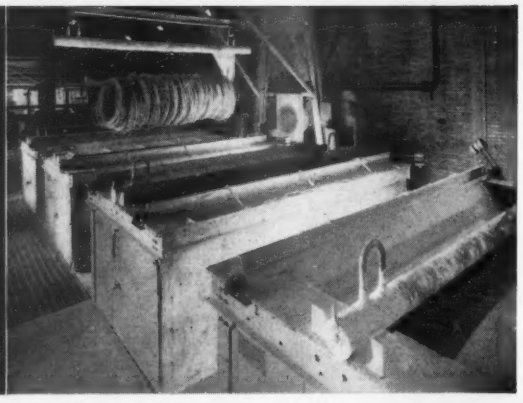
**carl mayer**

**HI-SPEED** REGISTERED

**ROD BAKERS**



Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

Here are just a few of our many satisfied customers:

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OTHER PRODUCTS: Core Ovens • Mold Ovens • Welding Rod Ovens • Heat Treating Ovens & Furnaces • Special Processing Equipment and Accessories.


## Variations in Preferred Orientation and Modulus of Elasticity, in Cold Drawn Music Spring Wire

(*Continued from page* 1376)

and 0.039", whose surfaces made angles of 0°, 30°, 60°, and 90° with respect to the wires' axes, showed that the intensity of diffraction from the (110) plane, $I_{110}$, and the ratio $I_{110}/I_{200}$ were (a) higher at 30° and 90° than at 0° and 60° for all specimens, and (b) the heights of these peaks increased with decreasing wire diameter. These results conformed with what would be expected for the usual (110) texture of preferred orientation in wire drawn from a body centered cubic metal. It was decided to add more data to the study by examining diffractions from cross sectional specimens of still other diameters; these data revealed complications. It was found that the $I_{100}$, and the ratio $I_{110}/I_{200}$ were no longer monotonic increasing functions of the reciprocal of the radius of the wire, but each exhibited a maximum for diffraction from the 0.047 inch diameter wire. The line broadening as calculated from the same data showed a maximum for the same specimen.

★ ★ ★

A diffraction trace was made of a specimen composed of 0.039 inch diameter wire which had been stress relieved at 750°F for 25 minutes. This trace showed a greater $I_{110}$ and a lesser line broadening than the 0.039 inch diameter wire that had not been stress relieved. The results obtained with the specimens cut transverse to the axes of the wires (90°) are given in Table II and shown in Figure 1.

★ ★ ★

It may be that the increase and subsequent decrease in the intensity of the (110) line as the diameter of the wire is decreased is due to the layer phenomenon ([6]) of preferred orientation in wires. It is known that the degree of alignment is strongest near the center of the wire and that a more conical texture predominates nearer the surface. Schmid and Boas ([7]) have shown that the center of

a cold drawn wire has a normal fiber texture while the exterior merges gradually into a simple "conical fiber texture" which is characterized by the fact that the preferred crystal axes constitute the generators of a simple circular cone about the central axes of the wire. The apex angle of the cone increases with the distance of the reference point from the axes of the wire until attaining approximately the angle of the die just under the surface of the wire.

★ ★ ★

**The** results reported here suggest that, as the diameter of the wire is reduced, the center shows more alignment, and the net contribution to the (110) diffraction from a cross section is at first increased; but after the diameter falls below some critical value, the conically orientated surface layer may become predominant, bringing about a reduction in the observed (110) intensity. The appearance of a maximum in line broadening is similar to the "recovery effect" observed by W. A. Wood. ([8]) Wood explained this on the theory that as the reduction in cross sectional area increases, the grains break down until a limiting crystallite size is reached. Line broadening, however, is due not only to small grain size but also to lattice distortion. When the critical reduction is passed, some of the distortion is removed by the "recovery effect"; and, since there is no decrease in grain size, there is a decrease in line broadening.

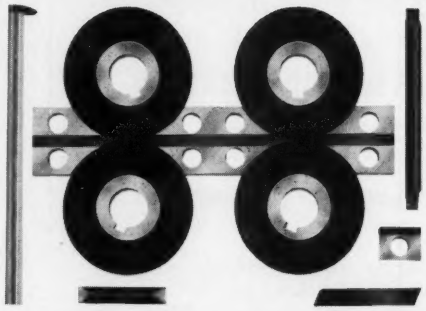
★ ★ ★

**Young's Modulus, (E):**—The results of tests to determine the modulus of elasticity of music wire at various stages of reduction are shown in Figure 2. The value of E rises to a maximum with wire of 0.047 inch diameter and thereafter decreases as did the preferred orientation data reported above. Apparently the development of preferred orientation is the principal factor contributing to the change of modulus.

★ ★ ★

**The** tensile strength of the wire, as given in Table I, continued to


CRAFTS ... for LONGER LIFE



Spring coiling machine tools made of tungsten carbide will outlast steel — but unless the grooves FIT your wire ALL AROUND — you are *not* getting *maximum* life.

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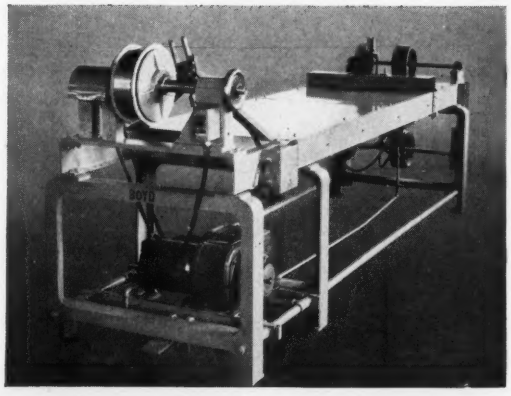
**The Boyd Micro-Spooler**



**Now you can get a perfect level layer wind on aluminum, stainless steel, bronze and all other types of welding wire in the complete diameter range.**

**The BOYD MICRO-SPOOLER (U. S. Patent #2862 filed Oct. 5th, 1954) is simple in operation. It requires no change gears. It operates at speeds up to 900 feet per minute. The perfect level layer wind will improve the operation of all metal inert gas shielded arc welding procedures.**

**A free demonstration is available. Send or bring a sample of your welding wire in a size down to 1/32″. We will wind it on your spools or ours with a perfect level layer wind. Your engineers may witness the operation if you wish.**

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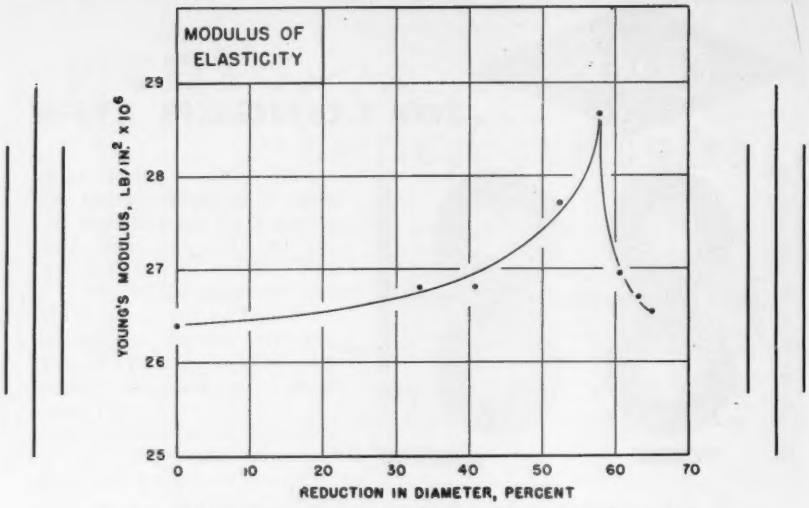


Figure 2. Modulus of elasticity of music wire at various stages of reduction.

increase with reduction and showed no correlation with the increasing and subsequent decreasing of the degree of preferred orientation and modulus of elasticity.

## VI. Conclusions

1. The degree of preferred orientation in cold drawn music spring wire (for one drawing schedule) was found to increase with reduction in size until a limiting diameter was reached and then to decrease.

2. Changes in the modulus of elasticity of the wire with increasing reduction were similar to the changes in preferred orientation, and the peak value was found at the same wire diameter.

3. The tensile strength of the wire increased with each reduction in wire size and exhibited no correlation with changes in either the preferred orientation or the modulus of elasticity.

4. This investigation indicates that the value of E may be used to indicate the degree of preferred orientation at various stages during the reduction of cold-drawn music wire.

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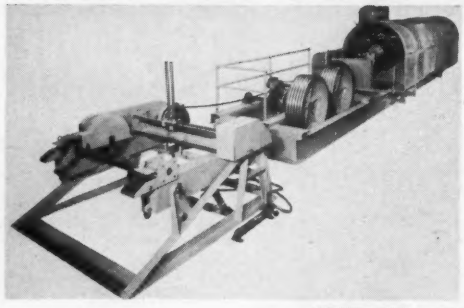
6. R. W. Drier and C. T. Eddy, Trans. A.I.M.M.E., Inst. Metals Div. 1930 (140-150).
7. Schmid and Boas, Plasticity of Crystals, 1950 (295-296).
8. W. A. Wood, Proceedings of the Royal Society (A), 1939, Vol. 172, p. 231.

## New Flexible Mechanical Coupling Catalog

**Philadelphia Gear Works,** Philadelphia, Pa., has prepared a new reference catalog on flexible, gear-type mechanical couplings which will be of special interest to designers, specifying engineers and purchasers. This 12-page catalog describes the new Sphereflex line of curved root, spherical tooth couplings; and provides complete data on installation, service factors, proper selection, specifications and lubrication. Featuring dimensional drawings of standard (Type K) couplings and mill motor couplings (Type MK), as well as horizontal floating shaft (Type EK), standard spacer (Type SK), vertical shaft (Type V) and vertical floating shaft (Type VEK) couplings, this new reference booklet tabulates complete dimensions and specifications in size numbers up to 6" nominal bore for each type of coupling. The data also covers horsepower load ratings for each size and type of coupling at 100 R.P.M. Dimensional drawings show all significant dimensions with specifications tabulated for each coupling type and size. This new Sphereflex booklet will prove a valuable source of information for anyone who specifies mechanical shaft couplings.

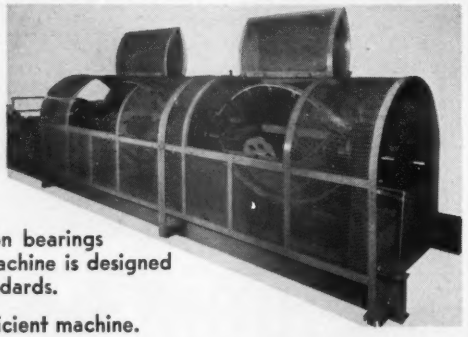
THREE-WIRE HEAVY DUTY TWISTING MACHINE



Built to handle wire from #14 to 500,000 circular mils in size on cradle reels.

Cradle reels either 30", 36" or 48" in diameter.

Rotor speeds from 800 r.p.m. to 30 r.p.m. controlled by gear box and dual drive.



Capstans either single with fleeter sheave or double as shown with diameters of 30", 36" or 42". Rates of lay from 1½" to 36".

Welded steel frame, anti-friction bearings and multiple roll guides. The machine is designed and built to our usual high standards.

An exceedingly versatile and efficient machine.

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## New Resinoid Wheel Bond

**In** its new B11 resinoid bond, **Norton Company** announces a significant step in the direction of greater uniformity of resinoid bonded grinding wheels. This new bond, used in conjunction with new molding and firing techniques, insures a much more uniform structure than has been possible in resinoid wheels previously.

★ ★ ★

**Increased** uniformity of structure or spacing of abrasive grains throughout the wheel is reflected in all-around improved performance. Specifically, this means more accurate and uniform work, improved surface finish, reduced diamond truing tool costs as well as lower unit grinding costs.

★ ★ ★

**The** improved uniformity of B11 resinoid bonded wheels insures better balance throughout the life of the wheel. This means better finish and better cutting action. This is particularly important on such precision operations as cam and roll grinding.

★ ★ ★

**Resinoid** wheels with this bond are available in a wide range of hardness grades and sizes. They have been tested successfully on almost all types of work using resinoid bonded wheels. Specifically, these wheels have been successfully applied to centerless, cam, roll, disc, and thread grinding operations in addition to snagging and surfacing.

## Ten Electrical Manufacturers Join NEMA

**Ten** more electrical manufacturers joined the **National Electrical Manufacturers Association** (NEMA), **A. F. Metz**, president of the Association, has announced.

★ ★ ★

**Their** election to membership raises the Association's register of member companies to 578.

★ ★ ★

**The** new members are: **Acme Battery Corp.**, Brooklyn, N. Y.; **Anderlab Inc.**, Aurora, Ill.; **Bright Star Industries**, Clifton, N. J.;


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**WIRE DRAWING LUBRICANTS**
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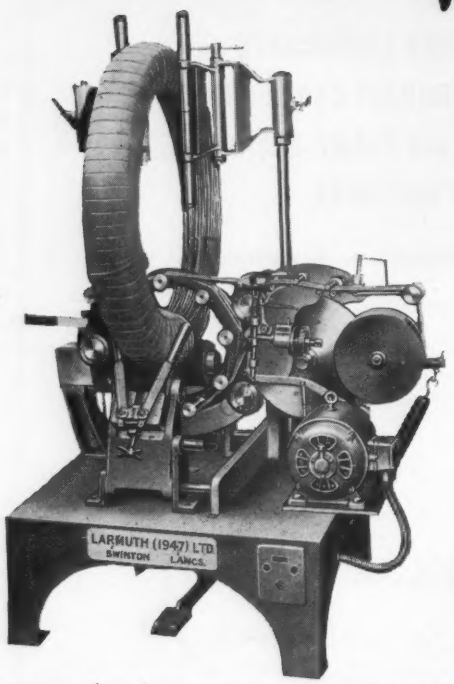


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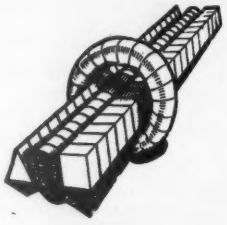
"BOUND" to get there safely.



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**Burgess Battery Company,** Freeport, Ill.; **General Dry Batteries, Inc.,** Cleveland, Ohio; **Hill Transformer Co., Inc.,** San Carlos, Cal.; **Marathon Battery Company,** Wausau, Wisc.; **Olin Mathieson Chemical Corp.,** New Haven, Conn.; **Ray-O-Vac Co.,** Madison, Wisc.; **United States Electric Mfg. Corp.,** New York City.

★ ★ ★

**NEMA** was formed twenty-nine years ago with definite aims to guide its future progress. These aims are: "To promote the interests of the public in manufacturing, engineering, safety, transportation, and other problems of the electrical industry, as well as: (1) To increase the amount and improve the quality of electrical service to the public; (2) to promote the standardization of electrical products; (3) to collect information relating to the industry and to disseminate it to members of the Association and to the public; (4) to cooperate with governmental departments and agencies regarding matters affecting the industry; and; (5) to promote a spirit of cooperation among the members in attaining improved production, enlarge distribution, and increased efficiency of the use of electrical products.

## Stainless Steel Wire Used in Homogenizing Milk

**Each** year about 14 billion gallons of milk are produced in the United States, about three-quarters of which, or 10 billion gallons, are homogenized.

★ ★ ★

**To** help produce homogenized milk, **The National-Standard Company,** Niles, Michigan, developed a stainless steel wire with special temper and finish that could be formed into valves under severe pressures without breaking. Through these conical-shaped valves milk is forced at high pressure, breaking the globules of butter fat into smaller ones, which results in a permanent blending of cream with milk.

★ ★ ★

**National - Standard's** engineers designed a wire hard enough to

mat up, yet sufficiently ductile to withstand tight crimping and sharp bending. This was accomplished by pre-selection of heats and the establishment of closely controlled wire drawing procedures. The wire also was designed to hold its formed shape precisely. Because it was unaffected by chemicals, stainless steel was selected as the proper metal thus eliminating the chance of contamination.

### New Screw Slotting Machine Has High Production Rates

A new screw head slotter capable of delivering up to 51,840 (Burr Free) slotted blanks per hour has been announced by the **Waterbury Farrel Foundry & Machine Co.,** Waterbury, Conn. Designated the "Model 5", the new machine exceeds the productive capacity of a pair of earlier model slotters of the type which used indexing dials and saw-fed-to-work sequence.

★ ★ ★

**The** new machine slots standard or special headed, ferrous or nonferrous blanks, #6 to ¼" diameter up to 2-½" long at variable speeds from 60 to 864 per minute. One dial, furnished as standard equipment feeds the above range of blank diameters. To handle other blank diameters the machine can be equipped with special dials.

★ ★ ★

**The** "Model 5" is designed to provide both long and short run versatility. Its simplicity and rapid set-up make it economical for short runs, while its high speed is a major advantage on long runs.

★ ★ ★

**Tooling** is low in cost, as the only tooling required are a saw and burr-remover blades made inexpensively from spring steel.

★ ★ ★

**For** further information, contact Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

### Continental Copper to Buy Spencer Wire

**Continental Copper & Steel Industries, Inc.** shareholders at the annual meeting approved the pur-


*Announcing a New Line of*

**WIRE DRAWING COMPOUNDS**

**for**

**STEEL, COPPER, BRASS, ALUMINUM, ETC.**

These new compounds for both WET AND DRY WIRE DRAWING have been under development and field test for 2 years and are showing superior results in leading wire mills, with savings in wire production—and in *original cost.*

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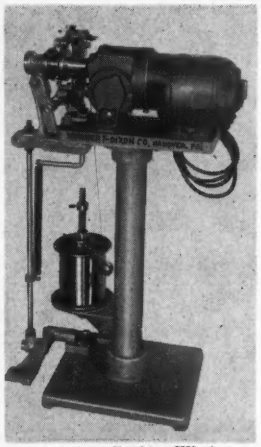
**FAST SINGLE BOBBIN WINDER**

**No. 440 FOR USE WITH**

**M-D WIRE LOOMS**

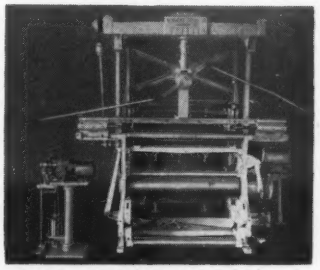


No. 440 Bobbin Winder

The winder shown at the left is designed to wind wire on bobbins as fast as the loom requires them. In fact, they will keep ahead of the loom's needs.

The winder is adjustable to bobbins of 3" or 4" in diameter and various widths of ½" to 1¼". Will wind a bobbin 3" diam. x 1" wide, of .011 wire in 8¼ minutes.

Traverse and wire guide are adjustable for any widths of movement desired. Will not pack wire so as to cause bobbin flange to bulge. The automatic stop is adjustable for any amount of fill required. The tail stock and other rollers have ball bearings.



Usually placed at L.H. side of loom.

The picture at the right shows the customary placement of the winder in juxtaposition with an M-D wire loom.

This small winder is carefully designed and made; needs only a minimum of attention.

*Ask for descriptive circular No. 9953.*

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chase of the **Spencer Wire Corporation** of Union, N. J.

★ ★ ★

**Spencer Wire** did about $13,000,000 in business last year, **Matthew J. Hall,** president of Continental, told stockholders.

★ ★ ★

**The** new addition enables Continental to step into the aluminum wire field when necessary due to the present shortage of copper.

★ ★ ★

**The** purchase of Spencer Wire is expected to add upwards of $250,000 to the company's consolidated earnings and should result in further substantial savings in manufacturing costs of insulated wire products.

★ ★ ★

**Continental's** Hatfield Wire & Cable division is one of the largest manufacturers of building wire in the country.

## Supplement to List of Books and Pamphlets

**In** 1952, the **Industrial Diamond Information Bureau,** 32 Holborn Viaduct, London E. C. 1, Eng. issued a List of Books and Pamphlets in its Library (214 pp) and now has published a Supplement of this list through December 1954.

★ ★ ★

**The** present supplement is arranged according to the UDC and appendices give new Reports of Investigations and information circulars of the US Bureau of Mines, reports of wartime agencies and a list of Russian books and translations available in the library.

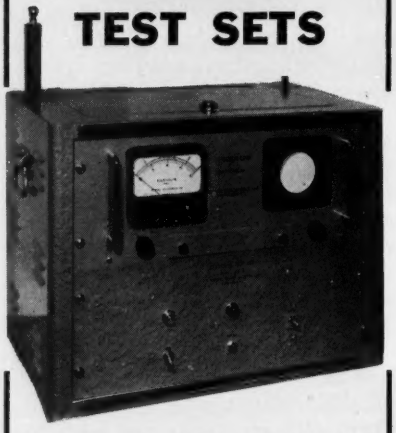
★ ★ ★

**The** original List of Books and Pamphlets issued 1952 has been out of print for a long time and this has now been reprinted lithographically with some minor corrections.

★ ★ ★

**The** Supplement will be sent, free of charge, to those interested in this field applying before the 1st January, 1956.


**CORONA TEST SETS**



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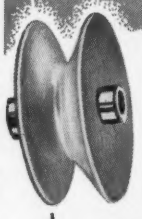

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CLEAN CUTTING SHEAR ACTION

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STEEL CABLE CUTTER

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PORTER Center-Cut CUTTERS

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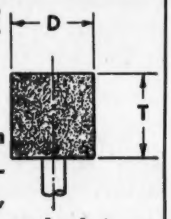
100 Grit

100 Concentration

mounted on mandrel 1½" long, ⅛" diam. Those marked * on ¼" diam. mandrel.

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## Plastic Coated Steel Wire

(*Continued from page* 1373)

drying the coil before rusting occurs.

### Wire Coatings to Maintenance Coatings

**Through** our efforts to create better wire coatings more easily applied with greater uniformity of final product, we have found and developed formulating techniques that have produced some very unique and economical maintenance finishes. Today with these maintenance materials we have progressed further into realms other than the wire industry. The fact that our material was the only one to complete successfully a year's test on a river barge carrying sulphur and soda ash, testifies to our progress also in the field of protective maintenance. We consider with optimism some of our products such as: glare reducing window coatings, glaze coats for concrete blocks, invisible silicone masonry saturants, just to mention a few of our specialty products.

### The Sales Potential

**Some** of the current uses of coated wire include stitching wire, staple wire, brush handle and broom wire, florist wire, box binding and baling wire, spiral binding and bookbinders wire.

★ ★ ★

**It** is tomorrow in which we are interested. We foresee all fencing sold in the southwest and coastal regions coated with a synthetic organic coating; all marine cable, both standing and running rigging, coated with a synthetic material rather than that mixture of lard, oil and lampblack so prevalent during the war. Spring wire, aircraft wire, upholstery wire and lamp shade frames are just a few more potentials that haven't been fully explored.

### In Summary

**Now** that we are to the present, a quick resume of what we of the coated wire industry have accomplished:

1. **Coating Speeds—To the best of our knowledge the maximum speed is two-hundred-forty feet (240') a minute.**

WEMCO MOLTEN METAL PUMP

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2. **Coating Thickness—All the way from one-tenth of a mil to five-tenths of a mil across the diameter.**
3. **Maximum Production—One operator services ten to sixteen take-up blocks plus tending the frame, or about 1700 pounds of 28 gauge wire per day.**
4. **Deformation—Reductions in cross sectional area of coated wire up to thirty-five per cent (35%). Flattening speeds up to 1600 feet a minute.**
5. **Coating Cost—A highly guarded secret beyond that the selling price is in the range of galvanized and tinned wire. Material costs vary widely with film thickness and size of wire. Unit price per gallon ranges from $3.00 to $4.00.**

## New Wire & Cable Developments Revealed at NEMA Meeting

(*Continued from page* 1378)

(Type THW) for use at 75C is also on the docket for consideration.

## NEMA Wire and Cable Section Has 38 Member Companies

**The** NEMA Wire and Cable Section, with 38 member companies, is representative of the entire register of 578 NEMA member companies, in its desire to promote a spirit of cooperation among its members in attaining improved production, enlarged distribution and increased efficiency in the use of electrical products.

★ ★ ★

**Other** speakers and their topics were: **H. W. Clough, Belden Manufacturing Company** — "Proposed Statistical Activity on Cord and Cord Sets;" **E. J. Merrell, Phelps Dodge Copper Products Corporation**—"Trend Towards Corrosive Protective Coverings;" **R. B. McKinley, General Electric Company** — "Design and Evaluation of Butyl Insulated Power Cable;" **R. A. Schatzel, Rome Cable Corporation**—"Proposals for Higher Utilization Voltages—Effect on Building Wire Products;" and **C. W. Higbee, United States Rubber Company**—"Aluminum as a Building Wire Conductor."


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It pays—send for rates
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## The Effect of Cold Reduction On Some Properties of Nickel Wire

(*Continued from page* 1358)

istic shape, with their size being a function of the time and temperature of annealing. The three materials investigated were shown to have varying rates of grain structure recovery when annealed. The rate of grain growth of "A" nickel with increased annealing temperatures was found to be fairly linear. Both "D" nickel and "Perma" nickel, on the other hand, showed a tendency for grain size to remain fairly constant up to a critical temperature above which grain growth progressed very rapidly. Figure 5 shows the effect of annealing on the grain structure of "D" nickel. "Perma" nickel, in particular, was very critical in this respect. With this material it appeared that a temperature change as small as 25°F might cause the grain size to more than double. Figure 6 includes photo-micrographs illustrating this condition. "Perma" nickel annealed at 1600°F shows a relatively fine grain structure while the same sample annealed at 1700°F indicates a many fold increase in grain size. Further increase in annealing temperature up to 1900°F shows continued grain growth at a very much slower rate. The photomicrographs were taken at 400 diameters magnification. "D" nickel photomicrographs illustrated material which had been reduced 85% and "Perma" nickel samples which had been reduced 80%.

### Summary

**In** summarizing the results obtained from this investigation of the effect of cold reduction on the properties of nickel wires of the "A", "D" and "Perma" nickel compositions, reduction percentages below 60% were shown generally to cause non-uniform properties after annealing. In the low range of reduction, annealing temperatures required to arrive at a given tensile strength were higher than those required to attain the same values for materials which had been cold worked in excess of 50%. Maximum uniformity of mechanical properties lay in the range of

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Hoskins Chromel "A"—Stainless, Soft and Spring Temper—Tag Wire, 1000
in an Envelope—Florist Wire—Spooled and Coiled, ¼-½-1-5#
Wires Straightened and Cut to length—Small Gauges—Small orders our specialty
Wires and Strands for the fishermen. Trolling Wires, Copper-Monel-Stainless.
Leader Wires, "Wilstabrite" Stainless and "Silverbrite" Music.

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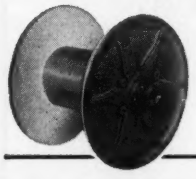

Having trouble with light weight reels failing in heavy duty service? Send us a sketch or print stating the limiting dimensions and service required, we'll be glad to tell you about our facilities for supplying the wire rope and cable industry with special heavy duty processing reels, spools or bobbins. WRITE FOR BULLETIN 52-W.

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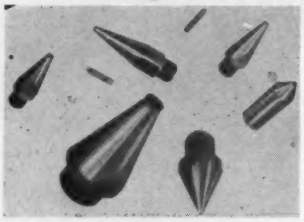

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They will save you money!

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Also, a full line of carbide tooling for the Cold Heading Industry

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reduction percentages between 60 and 95% for "A" nickel, between 60 and 90% for "D" nickel, and between 60 and 85% for "Perma" nickel. Closer annealing temperature control was necessary to produce uniformity of mechanical properties in "Perma" nickel than were required on either "A" or "D" nickel because of an inherent tendency of "Perma" nickel to exhibit rapid grain growth in the critical annealing temperature range. The best stability of yield strength was found to correspond to the reduction percentages giving the most uniform tensile properties. Maximum working ranges also were obtained in these areas. Maximum elongations were produced at reductions between 70 and 85% reduction for all materials. In general, it was noted that better elongations were obtained from the materials which were annealed at the minimum temperature required to give the desired tensile, yield and working range properties and corresponded to samples having small uniform grain structures.

★ ★ ★

The information gained in this study has been applied to the processing of nickel alloys for electronic tube application with very good success and has resulted in a noticeable improvement in general product uniformity. The actual values for reduction percentages and annealing temperatures will vary with the particular material in question and the particular circumstances which are dictated by production methods and customer specifications. In general, the effects of controlled reduction have been found to be a very important factor in establishing process parameters.

## References

(1) Materials Technology for Electron Tubes, Walter H. Kohl.

(2) Technical Bulletin T-16, Heat Treatment of "K" Monel and "Z" Nickel. International Nickel Company.

## Information Guide for Industrial Diamond Users

Advantages of diamond abrasive over silicon carbides both for rough grinding and in final polishing are

featured in a new industry-service pamphlet prepared by the abrasives division of **Elgin National Watch Company.**

★ ★ ★

**The** pamphlet, entitled "Metallographic Polishing With Diamond" has particular application to specimen polishing of metallic carbides and other metals, reports **C. R. Myer,** Abrasives Division Manager.

★ ★ ★

**The** booklet is the second in a series prepared by Elgin in a continuing program aimed at keeping industry informed on the effective and economical use of diamond.

★ ★ ★

**Information** was compiled after thorough tests in Elgin's own laboratories and with the aid of customer field observations.

★ ★ ★

**It** is available without cost by writing Abrasives Division, **Elgin National Watch Company,** Elgin, Illinois.

## Keystone Steel & Wire To Expand Capacity

A two-year expansion program, estimated to cost $10,000,000 to increase semifinished steel capacity, has been announced by **Keystone Steel & Wire Company,** Peoria, Ill.

★ ★ ★

**R. E. Sommers,** president, said the expansion, to take place at the Peoria plants, will increase capacity of these products by 50%.

★ ★ ★

**The** company plans to double the rolling mill capacity, enlarge its four open hearths, and increase wire mill capacities as the demand warrants.

★ ★ ★

**The** installation of additional rolling mill facilities will take a minimum of 18 months.

★ ★ ★

**Since** 1948, the company has invested $11,000,000 in plant improvements and additions. Additional plant capacity is needed chiefly because of a growing demand for the company's industrial


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THE BEST WIRE CUTTER MADE
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SIZES
8"
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For the finest quality, accurately graded diamond powders—specify DANFORTH.
They will cost more than "bargain basement" powders, but will finish your dies more economically.
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We will take your waste and reclaim it for you, guaranteeing that it will be 99% or better pure. Also, it will be returned properly graded for further use.
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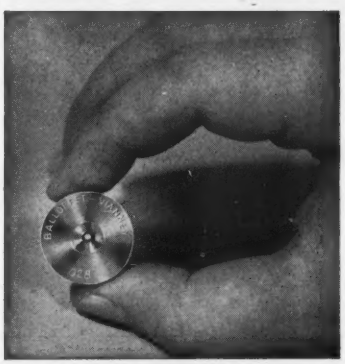
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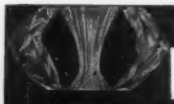

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wire, the president said. Industrial wire accounts for about half of the company's entire output.

★ ★ ★

In the first quarter of this year, Keystone had sales of over $28,000,000 with a net income of $2,700,000, making its net return on sales 9.5%.

★ ★ ★

In addition to its operations at Peoria, the company also owns a subsidiary, **Mid-States Steel & Wire Company** at Crawfordsville, Ind., which operates a plant in Jacksonville, Fla.

## Detroit's Airport Pioneers Use of Fabric

**Detroit's** Willow Run Airport, one of the nation's busiest, this summer became the first airport anywhere to use the "fabric-in-asphalt" process for major resurfacing of some of its vast pavement areas.

★ ★ ★

**Reason** for the resurfacing, involving the half mile long center taxi-way and the 3500 foot long west ramp, was to improve and extend the life of the original pavement in some areas and increase its ability to carry the tremendous loads of today's planes, up to 75,000 pounds, single wheel. Welded wire fabric reinforcement of the three inch thick bituminous concrete was specified to reduce the amount of "reflective" cracking of the new surface over the somewhat badly cracked unreinforced portland cement concrete slabs.

★ ★ ★

**The** original airport pavement, built in the early forties years by Defense Plants Corporation as part of the immense Willow Run bomber plant (now General Motor's transmission plant) is 6 to 8 inches thick, and was unreinforced, due to steel shortages. In certain areas, the 10 by 20 foot slabs, broken into smaller sections, with a good many corner cracks formed, especially at points of heavy traffic, were requiring extensive maintenance of the joints and cracks. The new resurfacing, fabric-reinforced is expected to reduce this maintenance cost as much as 70 percent.

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# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Special Shapes, Etc.**
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.

**DIES—Swaging**
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

**DIES—Tube Drawing**
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Michigan.

**DRAW BENCHES—**
(See MACHINERY—Draw Benches)

**DRUMS—Wire Packaging**
Continental Can Company, Van Wert, Ohio

**DRUMS & TRAVERSES—For Cable Reels**
Entwistle, James L., Co., Providence, R. I.
Hubbard Spool Co., Garrett, Ind.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

**DRYING EQUIPMENT**
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Ovens, Inc., Detroit, Michigan.
Rockwell, W. S. Co., Fairfield, Conn.

**ENGINEERS—Consulting**
Lubricants—Hans C. Bick, Inc., Reading, Pa.
Wire Mill—Clarence S. Arms, Worcester, Mass.

**EYELETS—Brass or Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

**FILM—Insulating**
Standard Film Products Corp., Pawtucket, R. I.

**FINISHERS—Flame Proof, for Wire**
Carbro Chemical Co., Pawtucket, R. I.

**FOAM PRODUCING COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

**FURNACES—Brazing**
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

**FURNACES—Galvanizing Equipment**
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Heat Treating**
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Drever Company, Bethayres, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Lead Melting**
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

**FURNACES—Pot (oil, gas, electric)**
Ajax Electric Co., Inc., Philadelphia, Pa.

**FURNACES—Resistance Heating, Strand**
(See Annealing Machines)

**FURNACES—Salt Bath**
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

**GAUGES—Wire Diameter, Continuous**
Industrial Gauges Corporation, West Englewood, N. J.

**GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)**

**GRINDERS—Roll**
Norton Co., The, Worchester, Mass.

**GUIDES—For Wire**
Heany Industrial Ceramic Corp., New Haven, Conn.
Lignum-Vitae Products Company, Jersey City, N. J.

**GUIDE TIPS—For Extruding Machines (See NOZZLES)**

**HAMMERS—Nail Heading**
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

**HAMMERS—Swaging**
Sjogren Tool and Machine Co., Auburn, Mass.

**HARDSURFACING ALLOYS—**
(See Alloys—Hardsurfacing)

**HOOKS—Pickling & Liming**
Lewis Welding and Engineering Corp., The, Bedford, Ohio
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

**HOISTS—Electric Travelling**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

**INHIBITORS—Pickling**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

**INSULATING MATERIALS—**
Carbro Chemical Company, Pawtucket, R. I.
Celanese Corporation of America, New York, N. Y.
Chemical Products Co., E. Providence, R. I.
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Co., St. Louis, Mo.
Naugatuck Chemical Div., U. S. Rubber Co., New York, N. Y.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Standard Film Products Corp., Pawtucket, R. I.
Synthetic Thread Corporation, Bethlehem, Pa.

**KETTLES—Galvanizing**
National Annealing Box Co., Washington, Pa.

**LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire**

**LACQUERS—For Electric Wire**
Chemical Products Co., E. Providence, R. I.

**LAGGING—Reel**
North Anson Reel Co., No. Anson, Me.

**LAME—LAHN—**
Kassel Export Company, New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

**LIME—**
Warner Co., The, Philadelphia and Bellefonte, Pa.

**LUBRICANTS — For Metal Cutting, Stamping and Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Chicago.

**LUBRICANTS—Wire Drawing**
(See Compounds—Wire Drawing)

**LUBRICANTS—Wire Rope**
Swift & Co., Chicago, Ill.
Ironsides Co., The, Columbus, Ohio

**LUBRICANTS—for Metal Cutting, etc.**
Ironsides Co., The, Columbus, Ohio

**MACHINERY—Armoring (Cable, Wire, Hose)**
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

**MACHINERY—Barbed Wire**
Glader Wm., Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

**MACHINERY—Bending Wire**
Eisler Engineering Co., Newark, N. J.

**MACHINERY—Bobbin Winders**
Mummert-Dixon Company, Hanover, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

**MACHINERY—Braiding**
New England Butt Co., Providence, R. I.
Wardwell Braiding Mach. Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

**MACHINERY—Bunching**
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Providence, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

**MACHINERY—Bundling, Scrap**
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Cable, Electric**
American Insulating Mach'y Co., Phila., Pa.
Haskell-Dawes Machine Co. Philadelphia, Pa.
New England Butt Co., Providence, R. I.
New York Engineering Co., Yonkers, N. Y.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Capstans (See Machinery—Winding Wire)**

**MACHINERY—Centerless Grinding**
Schumag Schumacher Metallwerke, Aachen, Germany.

**MACHINERY—Chain Making**
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

**MACHINERY—Closing Rope**
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

**MACHINERY—Coiling Rod**
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Cold Heading**
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Copper Wire Drawing**
American Insulating Mach'y Co., Phila., Pa.
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)**

**MACHINERY—Cutting**
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wells, Frank L., Co., Kenosha, Wis.

**MACHINERY—Diameter Testing Continuous**
Standard Electronic Research, New York, New York.

**MACHINERY—Descaling Rod, Dry**
Fisher Associates, New York, N. Y.
Herborn, Herborn, Germany.

**MACHINERY—Die Making**
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Wayne Wire Die Co., Hillside, N. J.

# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

### MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

### MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

### MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Ovens, Inc., Detroit, Michigan
Rockwell Co., W. S., Fairfield, Conn.

### MACHINERY—Extruding
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle, James L., Company, Providence, R. I.
Modern Plastic Machinery Co., Lodi, N. J.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

### MACHINERY—Fence
Blashill and Company, Arthur, Worcester, Mass.
Glader, Wm., Machine Works, Chicago, Ill.

### MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Mettler Machine Tool, Inc., New Haven, Conn.
Rockwell, W. S., Company, Fairfield, Conn.
Torrington Mfg. Co., Torrington, Conn.

### MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

### MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

### MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

### MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

### MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Ovens, Inc., Detroit, Michigan
Modern Plastic Machinery Company, Lodi, N. J.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Mach. Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

### MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.
Michigan Ovens, Inc., Detroit, Michigan

### MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

### MACHINERY—Looms, Wire Weaving
Mummert-Dixon Co., Hanover, Pa.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

### MACHINERY—Material Handling
(See Material Handling Equipment)

### MACHINERY—Measuring Wire & Cable
Davis Electric Company, Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, James L., Company, Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

### MACHINERY—Nail and Tack
Baird Machine Co., The Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Seybold Transworld Exporters, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

### MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.

### MACHINERY—Pickling
Lewis Welding & Engineering Corp., The, Bedford, Ohio
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

### MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

### MACHINERY—Pointing
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used). New York.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury Conn.

### MACHINERY—Pumps for Molten Metal
Wire Equipment Mfg. Co., Trenton, N. J.

### MACHINERY—Re-Spooling
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Company, Wallingford, Conn.
Emory, Robert J., Co., Newark, N. J.
Federal Manufacturing Co., Wallingford, Conn.
Mummert-Dixon Co., Hanover, Pa.
National Mach'y Exch. (Used), New York,
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

### MACHINERY—Rod Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Schumag Schumacher Metallwerke, Aachen, Germany

### MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

### MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Modern Plastic Machinery Co., Lodi, N. J.
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

### MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

### MACHINERY—Spark Testing
Davis Electric Company, Wallingford, Conn.
Entwistle, James L., Company, Providence, R. I.
Federal Manufacturing Co., Wallingford, Conn.
Modern Plastic Machinery Co., Lodi, N. J.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

### MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

### MACHINERY—Staple
Nilson, A. H. Machine Co., Bridgeport, Conn.
Seybold Transworld Exporters, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

### MACHINERY—Straightening & Cutting
Continental Fdy & Machine Co., Medart Division, Pittsburgh, Pa.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Wells, Frank L., Co., Kenosha, Wisc.

### MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

### MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

### MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Blashill and Company, Arthur, Worcester, Mass.
Davis Electric Company, Wallingford, Conn.
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle, James L., Company, Providence, R. I.
Federal Manufacturing Co., Wallingford, Ohio
Fenn Manufacturing Co., Newington, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Modern Plastic Machinery Co., Lodi, N. J.
New York Engineering Co., Yonkers, N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.

### MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

### MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Federal Manufacturing Co., Wallingford, Ohio
Peschel Electronics, Inc., New Rochelle, N. Y.

### MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

### MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.

### MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

### MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

### MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

### MACHINERY—Turks Head
Fenn Manufacturing Co., Newington, Conn.

### MACHINERY—Twinning
(See Mach.—Bunching)

### MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Company, Wallingford, Conn.
Edmands Company, The, Providence, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

### MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

### MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot)

### MACHINERY—Winding Wire
Emory, Robert J., Newark, N. J.
Entwistle, James L., Company, Providence, R. I.
Fenn Manufacturing Co., Newington, Conn.
Mummert-Dixon Co., Hanover, Pa.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.

# WHERE TO BUY, Continued

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**MACHINERY—Wire Drawing**
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Herborn, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
Morgardshammers Mek Verstads AB, Morgardshammer, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Schumag Schumacher Metallwerke, Aachen, Germany
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

**MACHINERY—Wire Forming**
Baird Machine Co., The, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Wire Rope**
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

**MACHINERY—Wrapping with Paper**
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Co., Boston, Mass.

**MATERIAL HANDLING EQUIPMENT—**
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

**NAIL TOOLING—Tungsten Carbide**
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

**NAILS—Wire**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

**NIPPERS—Wire Cutting**
Robinson, M. W. Co., Rockfall, Conn.

**NOZZLES—For Extruding Machines**
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

**OVENS—Cable Lacquering and Enameling**
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Ovens, Inc., Detroit, Michigan
Rockwell Co., W. S., Fairfield, Conn.

**OVENS—Rod Bakers**
Carl-Mayer Corp., The, Cleveland, Ohio

**OVENS—Welding Rod Coating**
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.

**PAINT BONDING CHEMICALS—**
American Chemical Paint Co., Ambler, Pa.

**PAINTS—Heat Resisting**
American Chemical Paint Co., Ambler, Pa.

**PANS—Spelter, Galvanizing, Lead**
National Annealing Box Co., Washington, Pa.

**PAPER—Creped Wrapping**
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

**PAPER—For Coil Wrapping and Corrosion Prevention**
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

**PATENT ATTORNEYS—**
Lancaster, Allwine & Rommel, Washington, D. C.

**PAY-OUT SYSTEMS—**
(See MACHINERY—Take-Up & Pay-Out)

**PHOSPHATE COATING CHEMICALS**
(See COMPOUNDS—Phosphate Coating)

**PICKLING COMPOUNDS—**
See (Inhibitors—Pickling)

**PICKLING—Hooks, etc. Acid Resisting**
Lewis Welding and Engineering Corp., The, Bedford, Ohio
Youngstown Welding & Eng'g Co., Youngstown, Ohio

**PICKLING TANK LININGS—**
Chemsteel Construction Co., Inc., Pittsburgh, Pa.
Haveg Corp., Newark, Del.

**PIPES & FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.

**PLASTICIZERS—**
Celanese Corporation of America, New York, N. Y.
Monsanto Chemical Co., St. Louis, Mo.
Naugatuck Chemical Div., U. S. Rubber Co., New York, N. Y.

**PLASTICS—for Wire Insulation**
Carbro Chemical Co., Pawtucket, R. I.
Celanese Corporation of America, New York, N. Y.
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Co., St. Louis, Mo.
Naugatuck Chemical Div., U. S. Rubber Co., New York, N. Y.

**POTS—Lacquer**
Industrial Ovens, Inc., Cleveland, Ohio

**POTS—Wire Tinning**
National Annealing Box Co., Washington, Pa.

**PULLERS AND GRIPS—For Wire**
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

**PUMPS—Molten Metal**
Fisher Associates, New York, N. Y.

**REEL AND TENSION STANDS—**
Davis Electric Company, Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio.
New York Engineering Co., Yonkers, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

**REEL CRUTCHES—**
Watson Machine Co., Paterson, N. J.

**REELS & SPOOLS—Aluminum Alloy**
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Wardwell Braiding Machine Co., Central Falls, R. I.

**REELS & SPOOLS—Annealing and Stranding**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

**REELS—Metal Bound**
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

**REELS—Plywood**
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., Wm., Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

**REELS & SPOOLS—Steel (All Types)**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

**REELS—Wire Mill**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
North Anson Reel Co., No. Anson, Me.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

**REELS & SPOOLS—Wood**
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

**REFRACTORIES—High Temperature**
Norton Company, Worcester, Mass.

**RETORTS—Annealing**
National Annealing Box Co., Washington, Pa.

**ROD BAKERS—**
(See OVENS—Rod Bakers)

**RODS—Stainless Steel**
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.

**RODS—Wire—Non-Ferrous**
Chase Brass & Copper Co., Waterbury, Conn.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Titan Metal Manufacturing Co., Bellefonte, Pa.

**RODS—Steel**
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Sheffield Steel Corp., Kansas City, Mo.
Youngstown Sheet & Tube Co., Youngstown, O.

**ROLLS—Wire Straightening**
Lignum-Vitae Products Corp., Jersey City, N. J.

**ROPE—Wire**
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

**RUST PROOF COMPOUNDS—**
(See COMPOUNDS—Rust Preventing)

**RUST REMOVING COMPOUNDS—**
(See COMPOUNDS—Rust Preventing)

**SATURANTS—Cable**
Carbro Chemical Company, Pawtucket, R. I.

**SATURATION SYSTEMS—**
Industrial Ovens, Inc., Cleveland, Ohio
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

**SHEAVES—Wood**
Lignum-Vitae Products Corp., Jersey City, N. J.

**SOAPS—Industrial and Wire Drawing**
(See COMPOUNDS—Wire Drawing)

**SPOOLS—(See Reels & Spools)**

**SPOOLS—Stamped Metal for Retail Wire Sales**
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

**STAMPINGS—Steel**
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**STRIP—Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

**TANKS—Compound**
National Annealing Box Co., Washington, Pa.
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.

**TANKS—Pickling and Plating**
Chemsteel Construction Co., Inc., Pittsburgh, Pa.
National Annealing Box Co., Washington, Pa.

**TESTERS — INSULATION**
(See MACHINERY—Spark Testers)

**TESTING EQUIPMENT**
(See MACHINERY Testing, Physical and Diameter Testing)

**TINSEL—Electric Conductor**
Kassel Export Company, New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

**TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc.**
(See TINSEL—Electric Conductor)

**TOOLS—Nail Machine**
Pittsburgh Carbide Die Co., Monongahela, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

**TOOLS—Wire Cutting**
Porter, H. K. Inc., Somerville, Mass.

**TOOLS—Spring Forming, Carbide**
Crafts, Arthur A., Company, Inc., Boston, Mass.

**TRAMRAIL SYSTEMS—**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

**TRANSMISSIONS—Variable speed (See Machy—Power Transmission)**

**TRAVERSES & DRUMS—For Reels**
(See Drums & Traverses)

**TRAVERSE MECHANISMS—**
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

**VALVES & FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.

**VARNISHES & LACQUERS—for Electric Wire**
Carbro Chemical Co., Pawtucket, R. I.
Chemical Products Co., E. Providence, R. I.

**VULCANIZING PANS AND EQUIPMENT—**
American Insulating Mach'y Co., Phila., Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**WELDERS—Spot and Butt**
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

**WIRE—Aluminum**
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.

**WIRE—Barbed**
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

**WIRE—Brass and Bronze**
Chase Brass & Copper Co., Waterbury, Conn.
Jury's Wire Products, Inc., Bloomfield, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.
Titan Metal Manufacturing Co., Bellefonte, Pa.

**WIRE—Brush**
Spencer Wire Corp., Union, N. J.

**WIRE—Bunched & Stranded, Copper**
Camden Wire Co., Camden, N. Y.
Utica Wire Corp., Derby, Conn.

**WIRE—Cast**
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Cold Heading**
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Camden Wire Co., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Titan Metal Manufacturing Co., Bellefonte, Pa.
Wickwire Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Copper**
Camden Wire Co., Inc., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Jury's Wire Products, Inc., Bloomfield, N. J.
Spencer Wire Corp., Union. N. J.
Utica Wire Corp., Derby, Conn.

**WIRE—For Electrical Conductors**
Camden Wire Co., Camden, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.

**WIRE—Flat, Fine**
Kassel Export Co., New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

**WIRE—Galvanized**
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

**WIRE—Magnet**
Kassel Export Company, New York, N. Y.

**WIRE—Manufacturers**
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Spencer Wire Corp., Union, N. J.
Titan Metal Manufacturing Co., Bellefonte, Pa.
U. S. Steel Corp., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Molybdenum**
Kassel Export Company, New York, N. Y.

**WIRE—Music**
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Kassel Export Co., New York, N. Y.
Malin & Co., The, Cleveland, Ohio
Spencer Wire Corp., Union, N. J.

**WIRE—Nickel Silver and Phosphor Bronze**
Alloy Metal Wire Div., H. K. Porter Co., Inc., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio
Titan Metal Manufacturing Co., Bellefonte, Pa.

**WIRE—Oil Tempered**
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.

**WIRE—Silver Plated Copper**
Camden Wire Co., Camden, N. Y.
Kassel Export Co., New York, N. Y.

**WIRE—Special Shapes**
Alloy Metal Wire Div., H. K. Porter Co., Inc., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Titan Metal Manufacturing Co., Bellefonte, Pa.

**WIRE—Spring**
Alloy Metal Wire Div., H. K. Porter Co., Inc., Pittsburgh, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Stainless Steel**
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.

**WIRE—Steel—Also Coppered and Galvanized Steel**
Alloy Metal Wire Div., H. K. Porter Co., Inc., Pittsburgh, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jury's Wire Products, Inc., Bloomfield, N. J.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Spencer Wire Corp., Union, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O

**WIRE—Straightening and Cutting**
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

**WIRE—Tinned Copper**
Camden Wire Co., Camden, N. Y.
Jury's Wire Products, Inc., Bloomfield, N. J.
Kassel Export Co., New York, N. Y.
Spencer Wire Corporation, Union, New Jersey
Utica Wire Corp., Derby, Conn.

**WIRE—Tungsten**
Kassel Export Company, New York, N. Y.

**WIRE—Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

**WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.**
Lignum-Vitae Products Corp., Jersey City, N. J.

**WRAPPING PAPER—Creped**
(See PAPER—Creped Wrapping)

**YARNS & TAPES—Insulating**
Celanese Corporation of America, New York, N. Y.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Standard Film Products Corp., Pawtucket, R. I.
Synthetic Thread Corporation, Bethlehem, Pa.

**YARN TESTERS—**
Scott Testers, Inc., Providence, R. I.

# The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

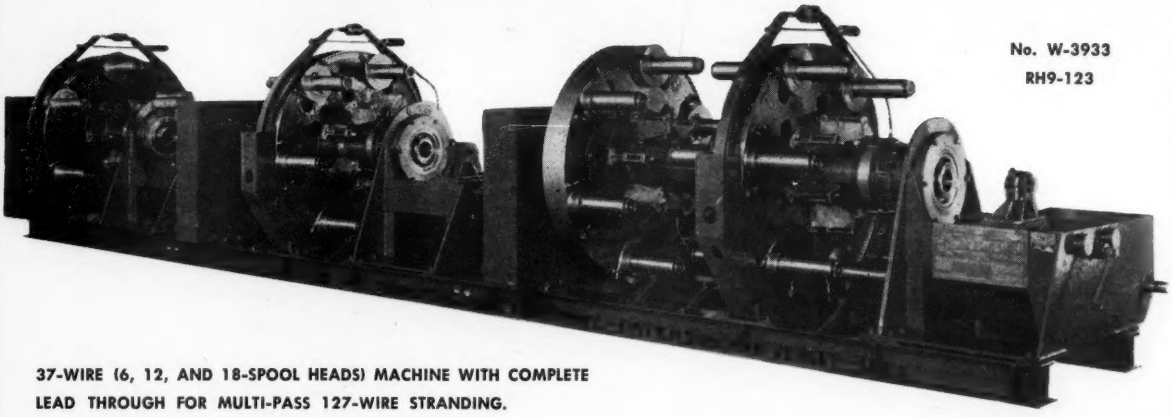
ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

# STRANDING HEADS TYPE "RH9"

**THIS RIGID FRAME HORIZONTAL DESIGN IS THE INDUSTRY'S PREFERRED MEDIUM FOR PRODUCING SOFT COPPER AND ALUMINUM MULTIPLE-LAYER CONCENTRIC STRAND OF ROUND OR SECTOR SHAPE.**

**THE RH9 HEADS CARRY STEEL SPOOLS 22" FLANGE DIAMETER x 11" TRAVERSE x 5" DIAMETER BORE, OF 650-POUND COPPER WIRE CAPACITY.**



No. W-3933
RH9-123

37-WIRE (6, 12, AND 18-SPOOL HEADS) MACHINE WITH COMPLETE LEAD THROUGH FOR MULTI-PASS 127-WIRE STRANDING.

**WHEN COMPARED WITH PLANETARY MACHINES OF SIMILAR UTILITY, THE FOLLOWING ADVANTAGES ARE NOTEWORTHY: MUCH LOWER INITIAL COST, LESS FLOOR AREA REQUIRED, CONSIDERABLY HIGHER SPEEDS, GREATLY REDUCED LOADING TIME, LESS POWER REQUIRED, FEWER OPERATORS REQUIRED, AND MAINTENANCE IS PRACTICALLY NIL.**

**OPEN DESIGN, WITH OVERHUNG SPINDLE MOUNT, ALLOWS UTMOST FREEDOM AND RAPIDITY OF LOADING AND THREADING. ALL STEEL AND BALL BEARING THROUGHOUT. FULLY ENCLOSED AND FORCE-FEED LUBRICATED DRIVE AND CHANGE GEARING. AUTOMATIC ELECTRIC STOPS FURNISHED. SPRING-SET AIR-RELEASED BRAKES.**

**ROLL-OVER EQUIPMENT ON HEADS FOR PRE-SPIRALED (PREFORMED) SECTOR STRANDS PROVIDED WHEN SPECIFIED.**

**COMPLETE LEAD-THROUGH FOR MULTI-PASS STRANDING AND TANDEM ARRANGEMENT INSTALLED WHEN REQUIRED.**

**THIS DESIGN IS ALSO AVAILABLE IN SMALLER SIZES AND GROUPING, WITH AUXILIARIES TO MEET ANY PRACTICAL RIGID FRAME STRANDING REQUIREMENT.**

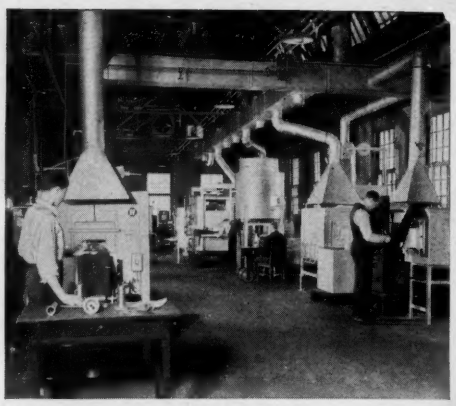
11-55

# RESEARCH DEPARTMENT

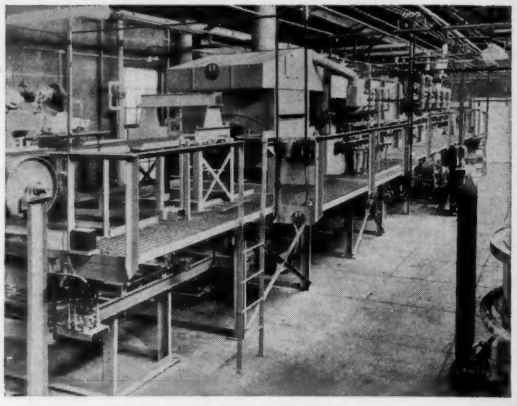
## *available to*

## PRODUCERS and PROCESSORS

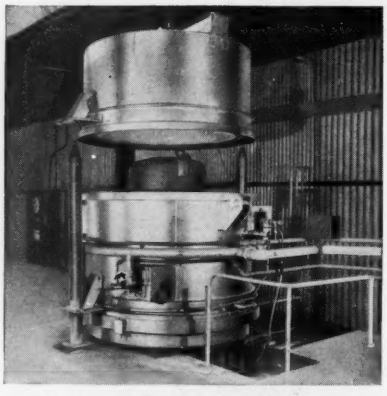
## *of metals and metal products*



General view of the research department showing several of the continuous and batch type experimental furnaces.



View of combination gas-fired and electric continuous furnace equipped with flame preheating burn-off or oxidizing section and controlled heating, soaking and cooling zones, for producing various surface conditions on strip.



Direct gas-fired forced circulation bell type furnace for processing wire, rod, strip and other products.

● The EF research department is equipped with gas-fired, oil-fired and electrically heated continuous and batch units including,—continuous wire mesh furnaces;—endothermic and exothermic special atmosphere generators;—forced circulation bell furnaces;—a continuous roller hearth furnace for treating commercial widths of ferrous and non-ferrous strip;—and other equipment.

Consequently, — from test runs — we can determine accurately the combination of temperature, time cycle, atmosphere and other factors needed to produce the exactly desired results, — assuring — in advance — the efficient performance of EF furnaces *fully up to specifications.*

Many large companies have drawn liberally upon this department in developing new products, and new techniques. Our facilities are available to YOU also — for YOUR research or development work, either gratis or for a moderate fee, depending upon the nature of the experiment. We will be glad to schedule time for your technicians.

**Write today for our 12 page booklet, "Research Facilities". It describes the equipment we can place at your disposal.**

## *Gas-Fired, Oil-Fired and Electric Furnaces*

***for any Process, Product or Production***

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